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EPA Utility FGD (Flue Gas Desulfurization) Survey December 1978-January 1979

PEDCo-Environmental, Inc, Cincinnati, OH

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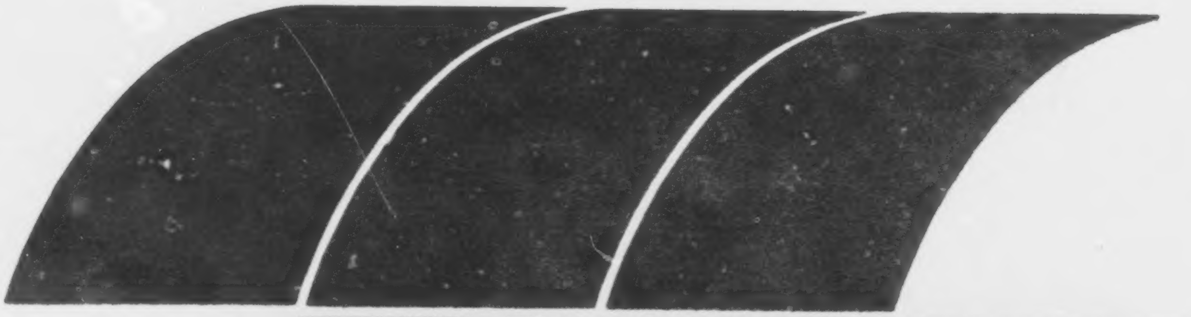

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16. ABSTRACT The report is the first in a series generated by a new computerized data base system and the first full compilation (not a supplement) since the December 1977 -January 1978 report. Because the next three reports are to be supplements, this issue should be retained for reference throughout the year. This report differs from the previous series in that the scope of design data for operating flue gas desulfurization (FGD) systems is expanded, section formats are revised, and a new section includes operational particulate scrubbers. The report surveys utility FGD systems in the U.S. It summarizes information contributed by the utility industry, process suppliers, regulatory agencies, and consulting engineering firms. Systems are tabulated alphabetically by development status (operational, under construction, or in planning stages), utility company, process supplier, process, waste disposal practice, and regulatory class. It presents data on system design, fuel sulfur content, operating history, and actual performance. It includes unit by unit dependability parameters and discusses problems and solutions associated with the boilers and FGD systems. Process flow diagrams and FGD system economic data are appended to the report. Current data show 46 operating FGD systems, 45 systems under construction, and 67 planned units. Projected 1988 FGD capacity is about 70,000 MW.

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Waste Disposal			15E
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by

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NOTICE

This report, (prepared by PEDCo Environmental, Inc., Cincinnati, Ohio, under EPA Contract No. 68-02-2603, Task No. 48) is provided as an information transfer document. Data in this report are supplied voluntarily by utility representatives; flue gas desulfurization (FGD) system designers, and suppliers; regulatory personnel; and others. Neither EPA nor the designated contractor warrants the accuracy or completeness of information contained in this report.

This report is the first in a series of four issues. The succeeding three issues will be supplemental in nature. It is suggested that the user retain this issue for reference throughout the year, because much of the information contained in this report will not be published again until around March 1980. Supplemental issues will be cumulative, so that it will be necessary only to retain the latest issue and this report to have all available information.

Initial distribution of the report (generally, one copy per company) is limited to organizations and individuals indicating a specific interest in the field of FGD technology. Additional copies of this report and succeeding issues can be purchased from National Technical Information Service, Springfield, Virginia 22151.

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EXECUTIVE SUMMARY

This report has been prepared every other month by PEDCo Environmental, Inc., under contract to the Industrial Environmental Research Laboratory/Research Triangle Park and the Division of Stationary Source Enforcement of the U.S. Environmental Protection Agency. After the February-March 1979 issue, reports will be issued quarterly (every three months). This is the first issue generated by a new computerized data base system, the structure of which is illustrated in Figure 1. This issue differs from the previous ones in that the scope of design data for operating FGD systems is vastly expanded, section formats are revised somewhat and a new section includes operational particulate scrubbers.

Table I summarizes the status of FGD systems in the United States during December 1978 and January 1979. Table II lists the units that changed status in this period, and Table III shows the performance of operating units.

TABLE I. NUMBER AND TOTAL CAPACITY OF FGD SYSTEMS

Status	No. of Units	Total Controlled Capacity, MW*	Equivalent Scrubbed Capacity, MW†
Operational	46	16,842	15,773
Under construction	45	18,927	16,924
Planned:			
Contract awarded	21	11,647	11,071
Letter of intent	2	1,100	960
Requesting/evaluating bids	11	9,156	8,268
Considering only FGD systems	33	17,784	17,014
TOTAL	158	75,456	70,010

* Total Controlled Capacity (TCC) is the summation of the gross unit capacities (MW) brought into compliance with FGD systems regardless of the percent of the flue gas scrubbed by the FGD system(s).

† Equivalent Scrubbed Capacity (ESC) is the summation of the effective scrubbed flue gas in equivalent MW based on the percent of the flue gas, scrubbed by the FGD system(s).

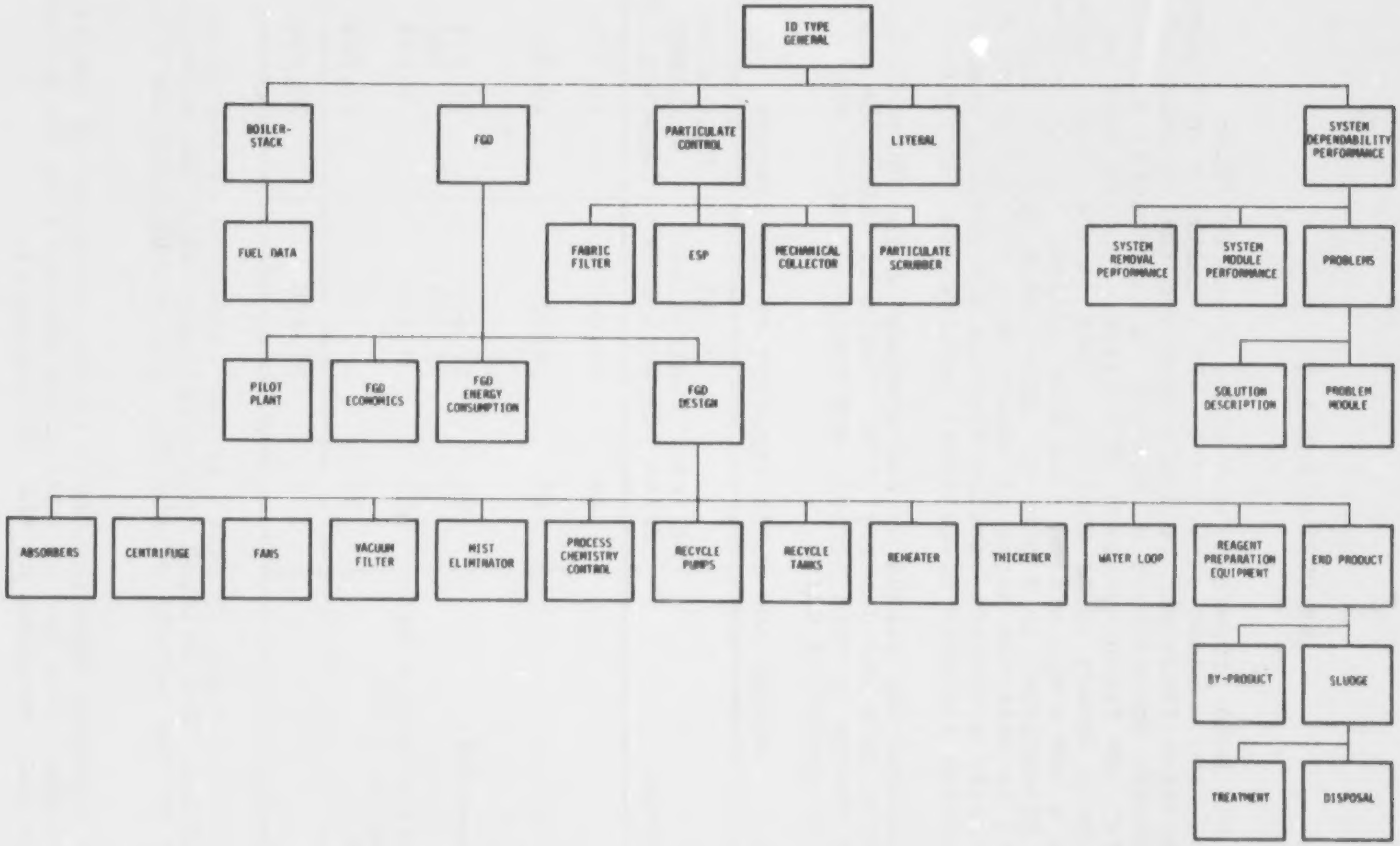
ID TYPE GENERAL
BOILER-STACK
FGD
PARTICULATE CONTROL
LITERAL
SYSTEM DEPENDABILITY PERFORMANCE
FUEL DATA
FABRIC FILTER
ESP
MECHANICAL COLLECTOR
PARTICULATE SCRUBBER
SYSTEM REMOVAL PERFORMANCE
SYSTEM MODULE PERFORMANCE
PROBLEMS
PILOT PLANT
FGD ECONOMICS
FGD ENERGY CONSUMPTION
FGD DESIGN
SOLUTION DESCRIPTION
PROBLEM MODULE
ABSORBERS
CENTRIFUGE
FANS
VACUUM FILTER
MIST ELIMINATOR
PROCESS CHEMISTRY CONTROL
RECYCLE PUMPS
RECYCLE TANKS
REHEATER
THICKENER
WATER LOOP
REAGENT PREPARATION EQUIPMENT
END PRODUCT
BY-PRODUCT
SLUDGE
TREATMENT
DISPOSAL

Figure 1. Computerized data base structure diagram.

TABLE II. SUMMARY OF CHANGES: FGD SUMMARY REPORT, DECEMBER 1978 - JANUARY 1979

FGD status report	Operational		Under construction		Contract awarded		Letter of intent		Requesting/ evaluating bids		Considering only FGD		Total	
	No.	MW*	No.	MW*	No.	MW*	No.	MW*	No.	MW*	No.	MW*	No.	MW*
11/30/78	46	15,773	43	15,892	20	10,520	3	1,820	5	3,224	27	13,364	144	60,593
Allegheny Power Mitchell 3											+1	300	+1	300
Cincinnati Gas & Electric East Bend 2			+1	650	-1	650								
Houston Light & Power Parish 8									+1	512			+1	512
Louisville Gas & Electric Trimble County 1											+1	575	+1	575
Louisville Gas & Electric Trimble County 2											+1	575	+1	575
Middle South Utilities Arkansas Coal 5									+1	890			+1	890
Middle South Utilities Arkansas Coal 6									+1	890			+1	890
Middle South Utilities Louisiana Coal 1									+1	890			+1	890
Middle South Utilities Louisiana Coal 2									+1	890			+1	890
Middle South Utilities Mississippi Coal 1									+1	890			+1	890
Middle South Utilities Mississippi Coal 2									+1	890			+1	890
Northern States Power Sherburne 4							-1	860					-1	860
Power Authority of New York Arthur Kill Plant											+1	700	+1	700
Southern California Edison Alamitos 6					+1	175							+1	175
Tennessee Valley Authority Cumberland											+1	600	+1	600
Tennessee Valley Authority Johnsonville									+1	600	-1	600		
Tennessee Valley Authority Paradise 1					+1	704			-1	704				
Tennessee Valley Authority Paradise 2					+1	704			-1	704				
Texas Power & Light Sandow 4			+1	382	-1	382								
Texas Utilities Mill Creek 1											+1	750	+1	750
Texas Utilities Mill Creek 2											+1	750	+1	750
TOTAL*	46	15,773	45	16,924	21	11,071	2	960	11	8,268	33	17,014	158	70,010

---

[*] Equivalent Scrubbed Capacity (as a result of the conversion to equivalent scrubbed capacity values, the totals as of 11/30/78 shown above have been modified accordingly and will therefore differ from the totals reported in the October-November 1978 Summary Report).

TABLE III. PERFORMANCE OF OPERATIONAL UNITS
DECEMBER 1978 - JANUARY 1979

Plant	FGD system capacity, MW[a]	Flue gas, % scrubbed	FGD capacity on line during period, MW[a,b]	No information for this period, MW	Shut down throughout period, MW	FGD system availability, %[c]		FGD system operability, %[c]		FGD system reliability, %[c]		FGD system utilization, %[c]	
						Dec.	Jan.	Dec.	Jan.	Dec.	Jan.	Dec.	Jan.
Tombigbee 2	179	70	179			95	95						
Apache 2	180	100			180								
Cholla 1	119	100	119					88	99	88	99	88	99
Cholla 2	350	100	350										
Duck Creek 1	416	100	416			20	0	21	0	21	0	20	0
Conesville 5	411	100	411			20	0	18	0	19	0	15	0
Conesville 6	411	100	411			31	0	23	0	23	0	21	0
Elrama	510	100	510									79	78
Phillips	410	100	410									74	72
Scholz 1-2	23	N/A[d]	23					100	100				
Petersburg 3	532	100	532										
Hawthorn 3	110	100	110										
Hawthorn 4	110	100	110										
LaCygne	874	100	874			94	96						
Jeffrey 1	540	75	540										
Lawrence 4	125	100	125										
Lawrence 5	420	100	420										
Green Rivers 1-3	64	100			64								
Cane Run 4	190	100			190								
Cane Run 5	200	100	200			53	70	46	67	46	67	41	63
Mill Creek 3	425	100			425								
Paddy's Run 6	70	100			70								
Milton R. Young 2	405	85	405										
Colstrip 1	358	100	358										
Colstrip 2	358	100	358										
Reid Gardner 1	125	100	125			96	84	93	74	93	74	92	67
Reid Gardner 2	125	100	125			96	83	100	81	100	81	13	74
Reid Gardner 3	125	100	125			100	66	100	67	100	67	100	66
Dean H. Mitchell 11	115	100	115			64	28			72	28	64	28
Sherburne 1	720	100	720			94	94						
Sherburne 2	720	100	720			97	93						
Bruce Mansfield 1	917	100	917										
Bruce Mansfield 2	917	100	917										
Eddystone 1A	120	N/A[d]	120										
San Juan 1	361	100	361										
San Juan 2	350	100	350										
Winyah 2	140	50	140			85	99	83	99	83	99	82	99
R.D. Morrow 1	124	62	124										
Southwest 1	194	100	194			63	21	55	25	55	25	49	15
Shawnee 10A	10	N/A[d]	10										
Shawnee 10B	10	N/A[d]	10										
Widows Creek 8	550	100			550								
Martin Lake 1	595	75	595										
Martin Lake 2	595	75	595										
Monticello 3	800	100	800										
Huntington 1	866	85	866					34	76			33	66
TOTAL	16,269		14,790		1,479								

[a] Equivalent scrubbed capacity.

[b] This category includes the flue gas capacity being handled by the FGD system at least part of the time during the report period.

[c] The percent figures listed are average values for all system scrubbing trains during the period.

[d] Flue gas % scrubbed for prototype and demonstration units is not applicable unless the system is designed to bring a unit into compliance with SO_2 emission standards.

The total power generating capacity of the electric utility industry in the United States is now approximately 564 GW.[a] Coal-fired units account for approximately 265 GW[b] or 47% of this total. As indicated in Table I, 46 power generating units (all coal-fired) are now equipped with operating FGD systems. These units represent a total controlled capacity of 16,842 MW, which is 3% of the total utility power generating capacity and just over 6% of the utility coal-fired capacity. Projections indicate that the total power generating capacity of the U.S. electric utility industry will be approximately 878 GW by 1988,[a] an increase of 56% over the present total. (This value reflects the annual loss resulting from the retirement of older units, which is considered to be 0.4% of the average generating capacity at the end of each year.) Approximately 395 GW[a,b,c] or 45% of the 1988 total will come from coal-fired units. Of the 158 FGD-equipped units (75,456 MW) shown in Table I, 156 (74,891 MW) are scheduled for operation by 1988. Therefore, approximately 8.5% of the projected total generating capacity and nearly 19% of the projected coal-fired capacity will be controlled by FGD by the end of 1988.

HIGHLIGHTS: DECEMBER 1978-JANUARY 1979

The following paragraphs highlight FGD system developments during December 1978 and January 1979.

Allegheny Power System (APS) plans to install an FGD system on Mitchell 3, a 300-MW (gross) coal-fired unit located in Courtney, Pennsylvania. The FGD system is currently scheduled to start up in August 1982. Design SO_2 removal efficiency is 95%. APS has not yet selected a process or system supplier. Bid request and evaluation will probably commence in September 1979.

Arizona Public Service reported that the Cholla 1 FGD system remained in service during the report period. The FGD system's average reliability for December and January was 88 and 99%, respectively. The boiler was in service 744 hours during each month.

Cincinnati Gas and Electric reported that construction began on the utility's 650 MW (Gross) East Bend 2 FGD installation. The B&W lime slurry system is designed to remove SO_2 with an 87% efficiency. A contract was awarded to IUCS for the sludge disposal system.

The Thoroughbred 121 prototype FGD system retrofitted on Gulf Power's Scholz 1 and 2 units achieved 100% operability during December and January. The Thoroughbred 121 facility removes SO_2 and flyash from an effective 23 MW capacity slip stream drawn from the two 47 MW (gross) Scholz units. Chiyoda International, the system supplier, reported that removal efficiencies for SO_2 have ranged from 93 to 95%.

Houston Lighting and Power reported that bids are now being requested for an FGD system planned for W.A. Parish 8, a new 550-MW coal-fired unit scheduled for start up in late 1982. The utility plans to equip the unit with a fabric filter for particulate matter control and a wet limestone FGD system for SO_2 control.

Kansas City Power and Light reported that the LaCygne 1 FGD system was in service during the report period, achieving average system availabilities of 94 and 96% for the months of December and January, respectively. Unit power production was limited by a number of boiler-related outages during the period, resulting in unit service times of 239 and 205 hours for December and January, respectively.

Louisville Gas and Electric (LG&E) reported that they are planning a new coal-fired power-generating station for installation in Bedford, Kentucky. The first two units of this new station, known as Trimble County, are each 575-MW (gross) pulverized coal-fired boilers supplied by Combustion Engineering. Each unit will be equipped with an electrostatic precipitator for the particulate matter control and an FGD system for SO_2 control. LG&E has not yet selected a process or supplier. Trimble County 1 is scheduled to start up in July 1984 and Trimble County 2 sometime in 1986.

Middle South Utilities reported that bid request and evaluation is now proceeding for six new 890-MW (gross) coal-fired boilers planned for installation at three separate stations in the utility's power-generating network. These new units are identified as Arkansas Coal 5 and 6, Louisiana Coal 1 and 2, and Mississippi Coal 1 and 2. The steam generators are pulverized coal-fired units supplied by Babcock and Wilcox. Either a low sulfur western grade of coal or lignite, with an average sulfur content of 0.5%, will be burned in the units. Currently, Middle South Utilities plans to start up Arkansas Coal 5 and 6 in January 1986 and January 1988, respectively; Louisiana Coal 1 and 2 in January 1986 and January 1988, respectively; and Mississippi Coal 1 and 2 in January 1985 and January 1987.

Nevada Power reported that the FGD systems for Reid Gardner 1, 2, and 3 were in service during December. FGD system availabilities for the month were 96, 96, and 100%, respectively.

Northern States Power reported that the FGD system availability for Sherburne 1 was 94% in both December and January and that the FGD system availability for Sherburne 2 was 97% in December and 93% in January.

A contract was awarded by SOHIO to Southern California Edison and Stearns-Roger for the installation of a lime FGD system on Southern California Edison's Alamitos 6 unit. This contractural agreement occurred as a result of an "emission offset" program that may enable SOHIO to build an oil terminal and storage facility at Long Beach, California. The contract requires Sohio to supply 100% of the FGD system capital cost and projected operating costs for a period of 15 years. The FGD system will scrub approximately one-third of the flue gas generated by the 480-MW Alamitos 6 unit. Alamitos 6 burns natural gas and oil (0.25% maximum sulfur content). The utility will use a horizontal spray tower to remove 95% of the SO_2 from the inlet gas stream to the scrubber. Sludge will be dried and trucked to a landfill. The FGD system is expected to be operating commercially by January 1982.

The Tennessee Valley Authority reported the following information for their FGD activities at the Cumberland, Johnsonville, and Paradise stations:

- TVA is planning to install a 600-MW equivalent FGD system at their existing 1300-MW (gross) coal-fired Cumberland Station. The system will be designed to remove 90% of the inlet SO_2. A process or system supplier has not been announced. If a lime or limestone system is selected, start up could occur as early as July 1982.

- TVA is requesting and evaluating bids for a 600-MW equivalent FGD system at their existing 1450-MW (gross) coal-fired Johnsonville Station. The system will use regenerable magnesium oxide scrubbing to remove 90% of the inlet SO_2. The system is scheduled to start up in December 1982.

- TVA has awarded a contract to Chemico for two limestone FGD systems for Paradise 1 and 2, two existing coal-fired units each rated at 704 MW (gross). Each system will include six scrubber modules, five of which are required for full load. Design SO_2 removal efficiency is 84.2%. The systems are scheduled to start up in 1982.

Texas Air Control Board reported that Texas Utilities plans to install an FGD system on their Mill Creek 1 and 2 lignite-fired units, located southwest of their Martin Lake Station. An FGD process has not yet been selected for the new 750 MW (gross) units, but the utility has decided to control particulate matter with electrostatic precipitators. Currently start-up dates are scheduled for 1985 and 1986 for units 1 and 3, respectively.

Virginia Electric and Power reported that state SO_2 emission requirement revisions will now allow the utility to operate Mt. Storm station without retrofitting the facility with an FGD system. The station has been deleted from the Utility FGD Survey Report.

Winyah 2 of South Carolina Public Service Authority achieved an FGD system availability of better than 99% in January. The boiler operated 744 hours and the FGD system operated 742 hours.

REFERENCES FOR EXECUTIVE SUMMARY

a. Sixth Biennial Survey of Power Equipment Requirements of the U.S. Electric Utility Industry: 1977-1986. Sponsored by the Power Equipment Division, National Electrical Manufacturers Association.

b. Temple, Barker, and Sloane, Inc. Policy Testing Model for Electric Utilities, Exhibit II-3.

c. Twelth Annual Power Engineering Survey, Power Engineering, April 1978.

EPA UTILITY FGD SURVEY: DECEMBER 1978 - JANUARY 1979

SECTION 1
SUMMARY LIST OF FGD SYSTEMS

COMPANY NAME/ UNIT NAME	UNIT NO.	UNIT LOCATION		START-UP DATE	STATUS	REG CLASS
ALABAMA ELECTRIC COOP						
TOMBIGBEE	2	LEROY	ALABAMA	9/78	1	A
TOMBIGBEE	3	LEROY	ALABAMA	6/79	2	A
ALLEGHENY POWER SYSTEM						
MITCHELL	3	COURTNEY	PENNSYLVANIA	8/82	6	B
PLEASANTS	1	BELMONT	WEST VIRGINIA	3/79	2	A
PLEASANTS	2	BELMONT	WEST VIRGINIA	3/80	2	A
ARIZONA ELECTRIC POWER COOP						
APACHE	2	COCHISE	ARIZONA	8/78	1	B
APACHE	3	COCHISE	ARIZONA	4/79	2	B
ARIZONA PUBLIC SERVICE						
CHOLLA	1	JOSEPH CITY	ARIZONA	10/73	1	B
CHOLLA	2	JOSEPH CITY	ARIZONA	4/78	1	B
CHOLLA	4	JOSEPH CITY	ARIZONA	6/80	2	B
FOUR CORNERS	1	FARMINGTON	NEW MEXICO	0/79	2	B
FOUR CORNERS	2	FARMINGTON	NEW MEXICO	0/79	2	B
FOUR CORNERS	3	FARMINGTON	NEW MEXICO	0/79	2	B
FOUR CORNERS	4	FARMINGTON	NEW MEXICO	0/82	3	B
FOUR CORNERS	5	FARMINGTON	NEW MEXICO	0/82	3	B
ASSOCIATED ELECTRIC COOP						
THOMAS HILL	3	MOBERLY	MISSOURI	1/82	3	A
BASIN ELECTRIC POWER COOP						
ANTELOPE VALLEY	1	BEULAH	NORTH DAKOTA	11/81	3	B
ANTELOPE VALLEY	2	BEULAH	NORTH DAKOTA	11/83	6	B
LARAMIE RIVER	1	WHEATLAND	WYOMING	4/80	2	A
LARAMIE RIVER	2	WHEATLAND	WYOMING	10/80	2	A
LARAMIE RIVER	3	WHEATLAND	WYOMING	4/82	3	A
BIG RIVERS ELECTRIC						
GREEN	1	SEBREE	KENTUCKY	12/79	2	A
GREEN	2	SEBREE	KENTUCKY	12/80	2	A
CENTRAL ILLINOIS LIGHT						
DUCK CREEK	1	CANTON	ILLINOIS	7/76	1	A
DUCK CREEK	2	CANTON	ILLINOIS	1/84	5	A
CENTRAL ILLINOIS PUBLIC SERV						
NEWTON	1	NEWTON	ILLINOIS	11/79	2	A
CENTRAL MAINE POWER						
SEARS ISLAND	1	PENOBSCOT BAY	MAINE	11/87	6	A
CINCINNATI GAS & ELECTRIC						
EAST BEND	2	RABBITHASH	KENTUCKY	10/81	2	A
COLORADO UTE ELECTRIC ASSN.						
CRAIG	1	CRAIG	COLORADO	3/79	2	B
CRAIG	2	CRAIG	COLORADO	3/79	2	B
COLUMBUS & SOUTHERN OHIO ELEC.						
CONESVILLE	5	CONESVILLE	OHIO	1/77	1	B
CONESVILLE	6	CONESVILLE	OHIO	6/78	1	B
POSTON	5	ATHENS	OHIO	0/83	6	B
POSTON	6	ATHENS	OHIO	0/85	6	B

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SECTION 1
SUMMARY LIST OF FGD SYSTEMS

COMPANY NAME/ UNIT NAME	UNIT NO.	UNIT LOCATION		START-UP DATE	STATUS	REG CLASS
COMMONWEALTH EDISON						
POWERTON	51	PERKIN	ILLINOIS	7/79	2	C
COOPERATIVE POWER ASSOCIATION						
COAL CREEK	1	UNDERWOOD	NORTH DAKOTA	5/79	2	A
COAL CREEK	2	UNDERWOOD	NORTH DAKOTA	10/80	2	A
DELMARVA POWER & LIGHT						
DELAWARE CITY	1-3	DELAWARE CITY	DELAWARE	4/80	2	C
DUQUESNE LIGHT						
ELRAMA	1-4	ELRAMA	PENNSYLVANIA	10/75	1	B
PHILLIPS	1-6	SOUTH HEIGHT	PENNSYLVANIA	7/73	1	B
EAST KENTUCKY POWER COOP						
SPURLOCK	2	MAYSVILLE	KENTUCKY	3/80	3	A
GENERAL PUBLIC UTILITIES						
COHO	1	ERIE	PENNSYLVANIA	5/88	6	A
SEWARD	7	SEWARD	PENNSYLVANIA	5/85	6	A
GULF POWER						
SCHOLZ	1,2	CHATTAHOOCHEE	FLORIDA	8/78	1	C
HOOSIER ENERGY						
MEROM	1	SULLIVAN	INDIANA	4/81	2	A
MEROM	2	SULLIVAN	INDIANA	1/82	2	A
HOUSTON LIGHTING & POWER CO.						
W.A. PARISH	8	BOOTH	TEXAS	10/82	5	A
INDIANAPOLIS POWER & LIGHT						
PETERSBURG	3	PETERSBURG	INDIANA	12/77	1	A
PETERSBURG	4	PETERSBURG	INDIANA	10/83	2	A
KANSAS CITY POWER & LIGHT						
HAWTHORN	3	KANSAS CITY	MISSOURI	11/72	1	B
HAWTHORN	4	KANSAS CITY	MISSOURI	8/72	1	B
LA CYGNE	1	LA CYGNE	KANSAS	2/73	1	C
KANSAS POWER & LIGHT						
JEFFREY	1	WAMEGO	KANSAS	8/78	1	B
JEFFREY	2	WAMEGO	KANSAS	6/80	2	B
LAWRENCE	4	LAWRENCE	KANSAS	1/76	1	B
LAWRENCE	5	LAWRENCE	KANSAS	11/71	1	B
KENTUCKY UTILITIES						
GREEN RIVER	1-3	CENTRAL CITY	KENTUCKY	9/75	1	C
LAKELAND UTILITIES						
MCINTOSH	3	LAKELAND	FLORIDA	10/81	3	A
LOUISVILLE GAS & ELECTRIC						
CANE RUN	4	LOUISVILLE	KENTUCKY	8/76	1	A
CANE RUN	5	LOUISVILLE	KENTUCKY	12/77	1	A
CANE RUN	6	LOUISVILLE	KENTUCKY	3/79	2	A
MILL CREEK	1	LOUISVILLE	KENTUCKY	4/81	2	B
MILL CREEK	2	LOUISVILLE	KENTUCKY	4/82	3	B
MILL CREEK	3	LOUISVILLE	KENTUCKY	8/78	1	B
MILL CREEK	4	LOUISVILLE	KENTUCKY	7/81	2	B
PADDY'S RUN	6	LOUISVILLE	KENTUCKY	4/73	1	C

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LOUISVILLE GAS & ELECTRIC						
TRIMBLE COUNTY	1	BEDFORD	KENTUCKY	7/84	6	D
TRIMBLE COUNTY	2	BEDFORD	KENTUCKY	0/84	6	D
MIDDLE SOUTH UTILITIES						
ARKANSAS COAL	5		ARKANSAS	1/86	5	D
ARKANSAS COAL	6		ARKANSAS	1/88	5	D
LOUISIANA COAL	1		LOUSIANA	0/86	5	D
LOUISIANA COAL	2		LOUSIANA	0/88	5	D
MISSISSIPPI COAL	1		MISSISSIPPI	0/85	5	D
MISSISSIPPI COAL	2		MISSISSIPPI	0/87	5	D
MINNESOTA POWER & LIGHT						
CLAY BOSWELL	4	COHASSET	MINNESOTA	5/80	2	A
MINNKOTA POWER COOPERATIVE						
MILTON R. YOUNG	2	CENTER	NORTH DAKOTA	9/77	1	B
MONTANA POWER						
COLSTRIP	1	COLSTRIP	MONTANA	9/75	1	A
COLSTRIP	2	COLSTRIP	MONTANA	5/76	1	A
COLSTRIP	3	COLSTRIP	MONTANA	7/80	3	B
COLSTRIP	4	COLSTRIP	MONTANA	7/81	3	B
NEVADA POWER						
HARRY ALLEN	1	N.E. LAS VEGAS	NEVADA	6/85	6	A
HARRY ALLEN	2	N.E. LAS VEGAS	NEVADA	6/86	6	A
HARRY ALLEN	3	N.E. LAS VEGAS	NEVADA	6/87	6	A
HARRY ALLEN	4	N.E. LAS VEGAS	NEVADA	6/88	6	A
REID GARDNER	1	MOAPA	NEVADA	4/74	1	A
REID GARDNER	2	MOAPA	NEVADA	4/74	1	A
REID GARDNER	3	MOAPA	NEVADA	6/76	1	A
REID GARDNER	4	MOAPA	NEVADA	0/83	6	A
WARNER VALLEY	1	ST. GEORGE	UTAH	6/84	6	A
WARNER VALLEY	2	ST. GEORGE	UTAH	6/85	6	A
NEW ENGLAND ELECTRIC SYSTEM						
BRAYTON POINT	3	SOMERSET	MASSACHUSETTS	0/ 0	7	C
NIAGARA MOHAWK POWER COOP						
CHARLES R. HUNTLEY	66	BUFFALO	NEW YORK	0/82	3	C
NORTHERN INDIANA PUB SERVICE						
BAILLY	7	CHESTERTON	INDIANA	0/ 0	6	C
BAILLY	8	CHESTERTON	INDIANA	0/ 0	6	C
DEAN H. MITCHELL	11	GARY	INDIANA	7/76	1	C
NORTHERN STATES POWER						
SHERBURNE	1	BECKER	MINNESOTA	3/76	1	B
SHERBURNE	2	BECKER	MINNESOTA	4/77	1	B
SHERBURNE	3	BECKER	MINNESOTA	5/84	4	B
OTTER TAIL POWER						
COYOTE	1	BEULAH	NORTH DOKOTA	5/81	2	B
PACIFIC GAS & ELECTRIC						
FOSSIL	1		CALIFORNIA	0/85	6	B
FOSSIL	2		CALIFORNIA	0/86	6	B

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PACIFIC POWER & LIGHT						
JIM BRIDGER	4	ROCK SPRINGS	WYOMING	9/79	2	B
PENNSYLVANIA POWER						
BRUCE MANSFIELD	1	SHIPPINGPORT	PENNSYLVANIA	12/75	1	B
BRUCE MANSFIELD	2	SHIPPINGPORT	PENNSYLVANIA	7/77	1	B
BRUCE MANSFIELD	3	SHIPPINGPORT	PENNSYLVANIA	4/80	2	B
PHILADELPHIA ELECTRIC						
CROMBY		PHOENIXVILLE	PENNSYLVANIA	6/80	6	B
EDDYSTONE	1A	EDDYSTONE	PENNSYLVANIA	9/75	1	B
EDDYSTONE	1B	EDDYSTONE	PENNSYLVANIA	6/80	4	B
EDDYSTONE	2	EDDYSTONE	PENNSYLVANIA	6/80	6	B
POTOMAC ELECTRIC POWER						
DICKERSON	4	DICKERSON	MARYLAND	5/85	6	D
POWER AUTHORITY OF NEW YORK						
ARTHUR KILL		STATEN ISLAND	NEW YORK	11/88	6	B
PUBLIC SERVICE OF INDIANA						
GIBSON	5	PRINCETON	INDIANA	0/82	5	A
PUBLIC SERVICE OF NEW MEXICO						
SAN JUAN	1	WATERFLOW	NEW MEXICO	4/78	1	B
SAN JUAN	2	WATERFLOW	NEW MEXICO	8/78	1	B
SAN JUAN	3	WATERFLOW	NEW MEXICO	6/79	3	B
SAN JUAN	4	WATERFLOW	NEW MEXICO	1/82	3	B
SALT RIVER PROJECT						
CORONADO	1	ST. JOHNS	ARIZONA	8/79	2	B
CORONADO	2	ST. JOHNS	ARIZONA	1/80	2	B
CORONADO	3	ST. JOHNS	ARIZONA	0/87	6	B
SAN MIGUEL ELECTRIC COOP						
SAN MIGUEL	1	SAN MIGUEL	TEXAS	8/80	2	A
SEMINOLE ELECTRIC						
SEMINOLE	1	PALATKA	FLORIDA	6/83	6	A
SIKESTON BOARD OF MUNIC. UTIL.						
SIKESTON	1	SIKESTON	MISSOURI	6/81	2	A
SOUTH CAROLINA PUBLIC SERVICE						
WINYAH	2	GEORGETOWN	SOUTH CAROLINA	7/77	1	A
WINYAH	3	GEORGETOWN	SOUTH CAROLINA	5/80	3	A
SOUTHERN CALIFORNIA EDISON						
ALAMITOS	6	SEAL BEACH	CALIFORNIA	1/82	3	D
SOUTHERN ILLINOIS POWER COOP						
MARION	4	MARION	ILLINOIS	5/79	2	A
MARION	5	MARION	ILLINOIS	0/84	6	A
SOUTHERN INDIANA GAS & ELEC						
A.B. BROWN	1	WEST FRANKLIN	INDIANA	3/79	2	A
SOUTHERN MISSISSIPPI ELECTRIC						
R.D. MORROW	1	HATTISBURG	MISSISSIPPI	8/78	1	A
R.D. MORROW	2	HATTISBURG	MISSISSIPPI	5/79	2	A

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SOUTHWESTERN ELECTRIC POWER						
HENRY W. PERKEY	1	HALLSVILLE	TEXAS	2/84	3	A
SPRINGFIELD CITY UTILITIES						
SOUTHWEST	1	SPRINGFIELD	MISSOURI	4/77	1	A
SPRINGFIELD WATER, LIGHT & PWR						
DALLMAN	3	SPRINGFIELD	ILLINOIS	8/80	2	A
ST. JOE ZINC						
G.F. WEATON	1	MONACA	PENNSYLVANIA	4/79	2	B
TAMPA ELECTRIC						
BIG BEND	4	TAMPA	FLORIDA	0/85	6	A
TENNESSEE VALLEY AUTHORITY						
CUMBERLAND		CUMBERLAND CITY	TENNESSEE	7/82	6	C
JOHNSONVILLE	1-10	NEW JOHNSONVILL	TENNESSEE	0/82	5	C
PARADISE	1	PARADISE	KENTUCKY	0/82	3	C
PARADISE	2	PARADISE	KENTUCKY	4/82	3	C
SHAWNEE	10A	PADUCAH	KENTUCKY	4/72	1	C
SHAWNEE	10B	PADUCAH	KENTUCKY	4/72	1	C
WIDOWS CREEK	7	BRIDGEPORT	ALABAMA	10/80	2	C
WIDOWS CREEK	8	BRIDGEPORT	ALABAMA	5/77	1	C
TEXAS MUNICIPAL POWER AGEACY						
GIBBONS CREEK	1	CARLOS	TEXAS	1/82	3	A
TEXAS POWER & LIGHT						
SANDOW	4	ROCKDALE	TEXAS	7/80	2	A
TWIN OAKS	1		TEXAS	8/83	6	A
TWIN OAKS	2		TEXAS	9/84	6	A
TEXAS UTILITIES						
FOREST GROVE	1	ATHENS	TEXAS	0/81	5	A
MARTIN LAKE	1	TATUM	TEXAS	4/77	1	A
MARTIN LAKE	2	TATUM	TEXAS	5/78	1	A
MARTIN LAKE	3	TATUM	TEXAS	2/79	2	A
MARTIN LAKE	4	TATUM	TEXAS	0/85	3	A
MILL CREEK	1	HENDERSON	TEXAS	0/85	6	D
MILL CREEK	2	HENDERSON	TEXAS	0/86	6	D
MONTICELLO	3	MT. PLEASANT	TEXAS	5/78	1	A
UTAH POWER & LIGHT						
EMERY	1	CASTLE DALE	UTAH	4/79	2	A
EMERY	2	CASTLE DALE	UTAH	6/80	2	A
HUNTINGTON	1	PRICE	UTAH	5/78	1	A
WISCONSIN POWER & LIGHT						
COLUMBIA	2	PORTAGE	WISCONSIN	1/80	3	A

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SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	ABSTRACT
ALABAMA ELECTRIC COOP TOMBIGBEE 2 NEW 255.0 MW (GROSS) 179.0 MW (ESC) COAL 1.15 %S BITUMINOUS LIMESTONE PEABODY PROCESS SYSTEMS ENERGY CONSUMPTION: ****% STATUS 1 STARTUP 9/78	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. PEABODY ENGINEERING WAS AWARDED A CONTRACT FOR THE INSTALLATION OF A LIMESTONE FGD SYSTEM ON THIS UNIT. A HIGH-EFFICIENCY ESP INSTALLED UPSTREAM OF THE FGD SYSTEM PROVIDES PRIMARY PARTICULATE CONTROL. THE FGD SYSTEM CONTAINS TWO SCRUBBING TRAINS, TREATING APPROXIMATELY 70% OF THE FLUE GAS FOR REMOVAL OF SO2. STACK GAS REHEAT IS NOT REQUIRED. THE UNIT IS CURRENTLY IN THE SHAKEDOWN-DEBUGGING PHASE OF OPERATIONS.
ALABAMA ELECTRIC COOP TOMBIGBEE 3 NEW 255.0 MW (GROSS) 179.0 MW (ESC) COAL 1.15 %S BITUMINOUS LIMESTONE PEABODY PROCESS SYSTEMS ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 6/79	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. PEABODY ENGINEERING WAS AWARDED A CONTRACT FOR THE INSTALLATION OF A LIMESTONE FGD SYSTEM ON THIS UNIT. A HIGH-EFFICIENCY ESP INSTALLED UPSTREAM OF THE FGD SYSTEM PROVIDES PRIMARY PARTICULATE CONTROL. THE FGD SYSTEM CONTAINS TWO SCRUBBING TRAINS, TREATING APPROXIMATELY 70% OF THE FLUE GAS FOR REMOVAL OF SO2. STACK GAS REHEAT IS NOT REQUIRED. THE UNIT IS CURRENTLY IN THE SHAKEDOWN-DEBUGGING PHASE OF OPERATIONS.
ALLEGHENY POWER SYSTEM MITCHELL 3 RETROFIT 300.0 MW (GROSS) 300.0 MW (ESC) COAL ***** %S ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 8/82	ALLEGHENY POWER SYSTEM WILL INSTALL FLUE GAS DESULFURIZATION EQUIPMENT ON UNIT 3 AT THE MITCHELL POWER STATION. THE UTILITY IS CURRENTLY IN THE PROCESS OF EVALUATING VARIOUS FGD TECHNOLOGIES. THE FGD INSTALLATION IS SCHEDULED TO BEGIN OPERATIONS IN AUGUST 1982.
ALLEGHENY POWER SYSTEM PLEASANTS 1 NEW 625.0 MW (GROSS) 519.0 MW (ESC) COAL 4.50 %S BITUMINOUS LIME BABCOCK & WILCOX ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 3/79	THE THREE PRINCIPAL OPERATING UTILITY COMPANIES OF THE ALLEGHENY POWER SYSTEM ARE INSTALLING AN EMISSION CONTROL SYSTEM FOR THIS NEW COAL-FIRED UNIT WHICH INCLUDES A HIGH-EFFICIENCY ESP UPSTREAM OF FOUR TRAY TOWERS FOR THE CONTROL OF PARTICULATES AND SULFUR DIOXIDE. DESIGN REMOVAL EFFICIENCIES FOR THIS EMISSION CONTROL SYSTEM ARE 90 AND 99.5 PERCENT, RESPECTIVELY. THE DRAVO CO. IS SUPPLYING THIOSORBIC LIME. THE CONSULTING ENGINEERING FIRM IS UNITED ENGINEERS AND CONSTRUCTORS. CURRENTLY, ERECTION OF THE SCRUBBING EQUIPMENT IS IN PROGRESS.
ALLEGHENY POWER SYSTEM PLEASANTS 2 NEW 625.0 MW (GROSS) 519.0 MW (ESC) COAL 4.50 %S BITUMINOUS LIME BABCOCK & WILCOX ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 3/80	THE THREE PRINCIPAL OPERATING UTILITY COMPANIES OF THE ALLEGHENY POWER SYSTEM ARE INSTALLING AN EMISSION CONTROL SYSTEM FOR THIS NEW COAL-FIRED UNIT WHICH INCLUDES A HIGH-EFFICIENCY ESP UPSTREAM OF FOUR TRAY TOWERS FOR THE CONTROL OF PARTICULATES AND SULFUR DIOXIDE. DESIGN REMOVAL EFFICIENCIES FOR THIS EMISSION CONTROL SYSTEM ARE 90 AND 99.5 PERCENT, RESPECTIVELY. THE DRAVO CO. IS SUPPLYING THIOSORBIC LIME. THE CONSULTING ENGINEERING FIRM IS UNITED ENGINEERS AND CONSTRUCTORS. CURRENTLY, FOUNDATION WORK ON THE SCRUBBER PLANT IS IN PROGRESS.
ARIZONA ELECTRIC POWER COOP APACHE 2 NEW 245.0 MW (GROSS) 180.0 MW (ESC) COAL .70 %S BITUMINOUS LIMESTONE RESEARCH COTTRELL ENERGY CONSUMPTION: ****% STATUS 1 STARTUP 8/78	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE FGD SYSTEM FOR THIS NEW 200 MW UNIT WAS SUPPLIED BY RESEARCH COTTRELL. THE DESIGN INCLUDES A 22 ACRE SLUDGE POND AND A 64 ACRE ASH POND, BOTH OF WHICH ARE UNLINED AND TEN FEET DEEP. A REHEAT SYSTEM IS NOT INCLUDED. THE LINERS USED IN THE STACK AND THE DUCTS THAT LEAD TO THE STACK ARE A NEW COLE BRAND CXL2000 WHICH HAS A VERY HIGH HEAT RESISTANCE. THIS UNIT BURNS BITUMINOUS COAL WITH ASH CONTENTS OF .7% AND 10% RESPECTIVELY. INITIAL OPERATION OF THIS UNIT BEGAN IN AUGUST, 1978.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	ABSTRACT
ARIZONA ELECTRIC POWER COOP APACHE 3 NEW 245.0 MW (GROSS) 180.0 MW (ESC) COAL .70 %S BITUMINOUS LIMESTONE RESEARCH COTTRELL ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 4/79	CONSTRUCTION OF UNIT 3 IS NOW ESSENTIALLY COMPLETE. STRUCTURE ERECTION OF THE SCRUBBER-ABSORBER TOWERS IS COMPLETE. EACH SCRUBBER CAN HANDLE 410,000 ACFM AT 270F AND RECIRCULATE 20,000 GPM OF SLURRY. THERE ARE CURRENTLY TWO PONDS WITH A TOTAL OF 20-YRS CAPACITY FOR DISPOSAL OF UNFIXATED SLUDGE. TWO ADDITIONAL PONDS ARE PLANNED PROVIDING AN ADDITIONAL 20 YRS OF DISPOSAL CAPABILITY. THERE WILL BE NO REHEAT. BECAUSE OF THE HIGH COST OF THE UNIT 2 STACK LINER, UNIT 3 WILL USE A CEILCOTE LINING INSTEAD OF THE CXL2000 USED IN UNIT 2.
ARIZONA PUBLIC SERVICE CHOLLA 1 RETROFIT 119.0 MW (GROSS) 119.0 MW (ESC) COAL .50 %S SUBBITUMINOUS LIMESTONE RESEARCH COTTRELL ENERGY CONSUMPTION: 4.2% STATUS 1 STARTUP 10/73	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION THIS LIMESTONE SCRUBBING SYSTEM WAS PLACED IN SERVICE IN OCTOBER 1973. THIS SCRUBBER PLANT CONSISTS OF TWO PARALLEL SCRUBBING TRAINS. PARTICULATE CONTROL IS PROVIDED BY TWO FLOODED DISC SCRUBBERS. SO2 CONTROL IS PROVIDED BY ONE PACKED (MUNTERS PACKING) TOWER (A-SIDE). FLUE GAS CLEANING WASTES ARE DISCHARGED TO AN EXISTING FLY ASH POND. NO WATER IS RECYCLED BACK FROM THE DISPOSAL POND. IN-LINE STEAM REHEATERS RAISE THE GAS TEMPERATURE 40 F.
ARIZONA PUBLIC SERVICE CHOLLA 2 NEW 350.0 MW (GROSS) 350.0 MW (ESC) COAL .50 %S SUBBITUMINOUS LIMESTONE RESEARCH COTTRELL ENERGY CONSUMPTION: ****% STATUS 1 STARTUP 4/78	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE CONTRACT FOR THIS WET LIMESTONE SCRUBBING SYSTEM WAS AWARDED BY THE UTILITY TO RESEARCH-COTTRELL, THE DESIGN INCLUDES MECHANICAL COLLECTORS FOR PRIMARY PARTICULATE REMOVAL. THE FGD SYSTEM CONSISTS OF FOUR PARALLEL FLOODED DISC AND PACKED TOWER ABSORBER TRAINS. THREE ARE REQUIRED FOR FULL LOAD CAPACITY. INITIAL OPERATIONS BEGAN IN APRIL 1978. COMPLIANCE TESTING WAS COMPLETED DURING THE SECOND WEEK OF AUGUST 1978. THE UNIT IS CURRENTLY UNDERGOING SHAKEDOWN AND DEBUGGING OPERATIONS.
ARIZONA PUBLIC SERVICE CHOLLA 4 NEW 350.0 MW (GROSS) 126.0 MW (ESC) COAL .50 %S LIMESTONE RESEARCH COTTRELL ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 6/80	UNIT NO. 4 IS CURRENTLY UNDER CONSTRUCTION. APS HAS AWARDED THE FGD CONTRACT TO RESEARCH COTTRELL. THE STATE REGULATORY AGENCY HAS NOT YET DECIDED THE EMISSION REGULATIONS WHICH WILL APPLY TO THE PLANT. THE C-E BOILER WILL FIRE THE SAME COAL AS CHOLLA NO.1, WITH SULFUR CONTENT OF 0.44-1.0 PERCENT. THE A-E FIRM IS EBASCO. THE FGD SYSTEM IS A DOUBLE LOOP LIMESTONE ABSORPTION PROCESS AND REVENUES OF THE CONTRACT TO R-C ARE REPORTED TO BE $5 MM. FOR CONTROL OF PARTICULATE, AN ESP WILL HANDLE 100% OF THE FLUE GAS.
ARIZONA PUBLIC SERVICE FOUR CORNERS 1 RETROFIT 175.0 MW (GROSS) 175.0 MW (ESC) COAL .75 %S LIME/ALKALINE FLYASH CHEMICO ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 0/79	APS IS UPGRADING THE OPERATIONAL PARTICULATE SCRUBBERS AT THE FOUR CORNERS 1,2, AND 3 FOR ADDITIONAL SO2 REMOVAL. CURRENTLY, EACH UNIT HAS 2 CHEMICO VENTURI SCRUBBER MODULES FOR PARTICULATE CONTROL. ROUGHLY 30% OF THE FLUE GAS SO2 CONTENT IS REMOVED AT THE PRESENT TIME IN THE VENTURIS WITH THE HIGH AKALINE FLYASH. NEW MEXICO APC OFFICIALS INDICATED THAT THE 5 FOUR CORNERS UNITS WILL BE REQUIRED TO REMOVE AT LEAST 67.5% OF THE STATION SO2(ALL 5 UNITS CONSIDERED TOGETHER). ADDITIONAL ALKALINITY WILL BE IMPARTED TO THE SCRUBBING SOLUTION BY ADDING LIME.
ARIZONA PUBLIC SERVICE FOUR CORNERS 2 RETROFIT 175.0 MW (GROSS) 175.0 MW (ESC) COAL .75 %S LIME/ALKALINE FLYASH CHEMICO ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 0/79	APS IS UPGRADING THE OPERATIONAL PARTICULATE SCRUBBERS AT THE FOUR CORNERS 1,2, AND 3 FOR ADDITIONAL SO2 REMOVAL. CURRENTLY, EACH UNIT HAS 2 CHEMICO VENTURI SCRUBBER MODULES FOR PARTICULATE CONTROL. ROUGHLY 30% OF THE FLUE GAS SO2 CONTENT IS REMOVED AT THE PRESENT TIME IN THE VENTURIS WITH THE HIGH ALKALINE FLYASH. NEW MEXICO APC OFFICIALS INDICATED THAT THE 5 FOUR CORNERS UNITS WILL BE REQUIRED TO REMOVE AT LEAST 67.5% OF THE STATION SO2(ALL 5 UNITS CONSIDERED TOGETHER). ADDITIONAL ALKALINITY WILL BE IMPARTED TO THE SCRUBBING SOLUTION BY ADDING LIME.

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STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	ABSTRACT
ARIZONA PUBLIC SERVICE FOUR CORNERS 3 RETROFIT 229.0 MW (GROSS) 229.0 MW (ESC) COAL .75 %S LIME/ALKALINE FLYASH CHEMICO ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 0/79	APS IS UPGRADING THE OPERATIONAL PARTICULATE SCRUBBERS AT THE FOUR CORNERS 1,2, AND 3 FOR ADDITIONAL SO2 REMOVAL. CURRENTLY, EACH UNIT HAS 2 CHEMICO VENTURI SCRUBBER MODULES FOR PARTICULATE CONTROL. ROUGHLY 30% OF THE FLUE GAS SO2 CONTENT IS REMOVED AT THE PRESENT TIME IN THE VENTURIS WITH THE HIGH AKALINE FLYASH. NEW MEXICO APC OFFICIALS INDICATED THAT THE 5 FOUR CORNERS UNITS WILL BE REQUIRED TO REMOVE AT LEAST 67.5% OF THE STATION SO2(ALL 5 UNITS CONSIDERED TOGETHER). ADDITIONAL ALKALINITY WILL BE IMPARTED TO THE SCRUBBING SOLUTION BY ADDING LIME.
ARIZONA PUBLIC SERVICE FOUR CORNERS 4 RETROFIT 755.0 MW (GROSS) 755.0 MW (ESC) COAL .75 %S LIME UNITED ENGINEERS ENERGY CONSUMPTION: ****% STATUS 3 STARTUP 0/82	THE UTILITY IS CURRENTLY EVALUATING THE DATA AND INFORMATION ACCUMULATED DURING THE HORIZONTAL PROTOTYPE SCRUBBING PROGRAM IN ORDER TO ASCERTAIN VARIOUS POSSIBLE STRATEGIES TO CONTROL THE EMISSIONS FROM THIS COAL FIRED 755-MW UNIT. ADS WILL BE REQUIRED TO REDUCE THE CURRENT LEVEL OF SO2 EMISSIONS FROM THE ENTIRE PLANT BY INCREASING THE REMOVAL EFFICIENCY TO AT LEAST 67.5%. A CONTRACT HAS BEEN AWARDED TO UNITED ENGINEERS FOR THE ENGINEERING AND CONSTRUCTION OF AN FGD SYSTEM.
ARIZONA PUBLIC SERVICE FOUR CORNERS 5 RETROFIT 755.0 MW (GROSS) 755.0 MW (ESC) COAL .75 %S LIME UNITED ENGINEERS ENERGY CONSUMPTION: ****% STATUS 3 STARTUP 0/82	THE UTILITY IS CURRENTLY EVALUATING THE DATA AND INFORMATION ACCUMULATED DURING THE HORIZONTAL PROTOTYPE SCRUBBING PROGRAM IN ORDER TO ASCERTAIN VARIOUS POSSIBLE STRATEGIES TO CONTROL THE EMISSIONS FROM THIS COAL FIRED 755-MW UNIT. APS WILL BE REQUIRED TO REDUCE THE CURRENT LEVEL OF SO2 EMISSIONS FROM THE ENTIRE PLANT BY INCREASING THE REMOVAL EFFICIENCY TO AT LEAST 67.5%. A CONTRACT HAS BE AWARDED TO UNITED ENGINEERS FOR THE ENGINEERING AND CONSTRUCTION OF AN FGD SYSTEM.
ASSOCIATED ELECTRIC COOP THOMAS HILL 3 NEW 730.0 MW (GROSS) 670.0 MW (ESC) COAL 4.80 %S LIMESTONE PULLMAN KELLOGG ENERGY CONSUMPTION: ****% STATUS 3 STARTUP 1/82	ASSOCIATED ELECTRIC COOP AWARDED A CONTRACT TO PULLMAN KELLOGG FOR THE ENGINEERING, PROCUREMENT AND CONSTRUCTION OF AN FGD SYSTEM ON THE UTILITY'S THOMAS HILL UNIT NO. 3 POWER PLANT. SO2 REMOVAL EQUIPMENT WILL OPERATE IN CONJUNCTION WITH A HIGH EFFICIENCY ESP. THE SYSTEM, SCHEDULED FOR START-UP IN 1982, WILL UTILIZE MAGNESIUM-PROMOTED LIMESTONE AS A REAGENT IN THE FOUR MODULE WEIR FGD SYSTEM. REHEAT WILL PROBABLY NOT BE INCLUDED. THE STACK WILL BE BRICK LINED. THE DRY FIXATED SLUDGE WILL BE HAULED TO AN ACTIVE STRIP MINE. CONSTRUCTION OF THE BOILER HAS BEGUN.
BASIN ELECTRIC POWER COOP ANTELOPE VALLEY 1 NEW 440.0 MW (GROSS) 440.0 MW (ESC) COAL .68 %S LIGNITE LIME (DRY COLLECTION) JOY MFG. CO, WESTERN PRECIPITA ENERGY CONSUMPTION: ****% STATUS 3 STARTUP 11/81	THE UTILITY HAS SELECTED A LIME SCRUBBING PROCESS FOR THEIR PLANNED FGD SYSTEM. THE UNIT WILL FIRE LIGNITE COAL WITH A SULFUR CONTENT OF 0.68 PERCENT AND AN ASH CONTENT OF 8.0 PERCENT (6600 BTU/LB). THE WATER LOOP WILL BE OPEN WITH MAKE-UP COMING FROM COOLING TOWER BLOWDOWN. THE SLUDGE WILL BE DISPOSED IN A MINE LANDFILL. A CONTRACT HAS BEEN AWARDED TO WESTERN PRECIPITATION DIVISON, JOY MFG. CO. FOR A DRY FGD SYSTEM. THE SPRAY DRYER HAS BEEN SUBCONTRACTED TO NIRO ATOMITER.
BASIN ELECTRIC POWER COOP ANTELOPE VALLEY 2 440.0 MW (GROSS) 440.0 MW (ESC) COAL .68 %S LIGNITE PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 11/83	THE UTILITY IS TENTATIVELY INVESTIGATING VARIOUS FGD PROCESSES FOR THIS SECOND LIGNITE-FIRED UNIT SCHEDULED AT THE NEW STATION LOCATED IN MERCER COUNTY, NEAR BEULAH, NORTH DAKOTA. THIS NEW FACILITY WILL BE KNOWN AS THE ANTELOPE VALLEY STATION AND WILL BE REQUIRED TO COMPLY WITH STATE AIR EMISSIONS STANDARDS VIA THE BEST AVAILABLE TECHNOLOGY. START-UP IS NOW SCHEDULED FOR NOVEMBER 1983.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	ABSTRACT
BASIN ELECTRIC POWER COOP LARAMIE RIVER 1 NEW 600.0 MW (GROSS) 600.0 MW (ESC) COAL .80 %S LIMESTONE RESEARCH COTTRELL ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 4/80	RESEARCH-COTTRELL IS CURRENTLY FABRICATING THE DUAL-LOOP LIMESTONE WET SCRUBBERS. ON-SITE CONSTRUCTION COMMENCED IN JANUARY 1978. SLUDGE WILL BE DEWATERED TO 83% SOLIDS BEFORE LANDFILL. THE SCRUBBERS WILL BE MADE OF STAINLESS STEEL AND WILL HANDLE 2.3 MM ACFM AT 286 F. L/G RATIO WILL BE 60. B&W HAS BEEN AWARDED A CONTRACT FOR TWO ESP'S. THE DESIGN DOES NOT INCLUDE STACK GAS REHEAT. COOLING TOWER BLOWDOWN WILL BE USED FOR MAKE-UP WATER IN THIS CLOSED LOOP SYSTEM. CONSTRUCTION IS NOW 20% COMPLETE.
BASIN ELECTRIC POWER COOP LARAMIE RIVER 2 NEW 600.0 MW (GROSS) 600.0 MW (ESC) COAL .80 %S LIMESTONE RESEARCH COTTRELL ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 10/80	RESEARCH-COTTRELL IS CURRENTLY FABRICATING THE DUAL-LOOP LIMESTONE WET SCRUBBERS. ON-SITE CONSTRUCTION COMMENCED IN JANUARY 1978. SLUDGE WILL BE DEWATERED TO 83% SOLIDS BEFORE LANDFILL. THE SCRUBBERS WILL BE MADE OF STAINLESS STEEL AND WILL HANDLE 2.3 MM ACFM AT 286 F. L/G RATIO WILL BE 60. B&W HAS BEEN AWARDED A CONTRACT FOR TWO ESP'S. THE DESIGN DOES NOT INCLUDE STACK GAS REHEAT. COOLING TOWER BLOWDOWN WILL BE USED FOR MAKE-UP WATER IN THIS CLOSED LOOP SYSTEM. CONSTRUCTION IS NOW 20% COMPLETE.
BASIN ELECTRIC POWER COOP LARAMIE RIVER 3 NEW 600.0 MW (GROSS) 600.0 MW (ESC) COAL .80 %S LIME (DRY COLLECTION) BABCOCK & WILCOX ENERGY CONSUMPTION: ****% STATUS 3 STARTUP 4/82	LARAMIE RIVER STATION WILL FIRE SUBBITUMINOUS COAL WITH THE FOLLOWING CHARACTERISTICS: 8100 BTU/LB, 0.8 PERCENT SULFUR AND 7.0 PERCENT ASH A CONTRACT FOR A DRY TYPE FGD SYSTEM HAS BEEN AWARDED TO BABCOCK & WILCOX.
BIG RIVERS ELECTRIC GREEN 1 NEW 242.0 MW (GROSS) 242.0 MW (ESC) COAL 3.75 %S BITUMINOUS LIME AMERICAN AIR FILTER ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 12/79	THE EMISSION CONTROL SYSTEM FOR THIS NEW COAL-FIRED UNIT IS BEING SUPPLIED BY AMERICAN AIR FILTER. THE SYSTEM WILL CONSIST OF A COLD-SIDE ESP AND TWO SPRAY TOWERS CONTROLLING PARTICULATE AND SO2 TO 99.6 PERCENT AND 90 PERCENT, RESPECTIVELY. THE B&W BOILER WILL FIRE HIGH SULFUR (3.5 TO 4.5 PERCENT) WESTERN KENTUCKY COAL. CONSTRUCTION IS NOW 66% COMPLETE ON THE BOILER AND 50% COMPLETE ON THE FGD SYSTEM. THE DESIGN INCLUDES AN INDIRECT HOT AIR REHEAT SYSTEM. IUCS WILL CONSTRUCT A SLUDGE DISPOSAL SYSTEM TO SERVICE BOTH GREEN 1 AND 2.
BIG RIVERS ELECTRIC GREEN 2 NEW 242.0 MW (GROSS) 242.0 MW (ESC) COAL 3.75 %S BITUMINOUS LIME AMERICAN AIR FILTER ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 12/80	THE EMISSION CONTROL SYSTEM FOR THIS NEW COAL-FIRED UNIT IS BEING SUPPLIED BY AMERICAN AIR FILTER. THE SYSTEM WILL CONSIST OF A COLD SIDE ESP AND TWO SPRAY TOWERS CONTROLLING PARTICULATE AND SO2 TO 99.6 PERCENT AND 90 PERCENT, RESPECTIVELY. THE B&W BOILER WILL FIRE HIGH SULFUR (3.5 4.5 PERCENT) WESTERN KENTUCKY COAL. THE FGD SYSTEM WILL INCLUDE AN INDIRECT HOT AIR REHEAT SYSTEM. IUCS WILL CONSTRUCT A SLUDGE DISPOSAL SYSTEM TO SERVICE BOTH GREEN 1 AND 2. THE BOILER IS CURRENTLY 8% COMPLETE AND CONSTRUCTION HAS JUST BEGUN ON THE FGD SYSTEM.
CENTRAL ILLINOIS LIGHT BUCK CREEK 1 NEW 416.0 MW (GROSS) 416.0 MW (ESC) COAL 3.30 %S BITUMINOUS LIMESTONE RILEY STOKER/ENVIRONEERING ENERGY CONSUMPTION: ****% STATUS 1 STARTUP 7/76	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. RILEY STOKER WAS THE SUPPLIER OF THE FOUR VENTURI-ABSORBER MODULES AT THIS UNIT. SCRUBBER TANKS AND PUMPS ARE NEOPRENE LINED. A HIGH EFFICIENCY ESP IS UPSTREAM OF THE FOUR VENTURI-ABSORBER SCRUBBER MODULES FOR PARTICULATE CONTROL. THE CONCRETE STACK IS LINED WITH CEILCOTE FLAKELINE 151. NO RE-HEAT SYSTEM IS INCLUDED. THE FIRST LIMESTONE SLURRY SCRUBBER MODULE WAS PLACED IN SERVICE ON SEPTEMBER 9,1976, AND OPERATED INTERMITTENTLY UNTIL APRIL 1, 1977. ALL FOUR MODULES BECOME OPERATIONAL ON JULY 24, 1978.

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UNIT IDENTIFICATION	ABSTRACT
CENTRAL ILLINOIS LIGHT DUCK CREEK 2 NEW 416.0 MW (GROSS) 416.0 MW (ESC) COAL 3.30 %S BITUMINOUS LIMESTONE VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 5 STARTUP 1/84	THE UTILITY HAS NOT YET SELECTED A SYSTEM SUPPLIER. THE UTILITY WILL USE ESP'S FOR PARTICULATE CONTROL AND EITHER LIMESTONE OR DOUBLE ALKALI FOR SO2 ABSORPTION. THE UTILITY IS NOW IN THE PROCESS OF EVALUATING BIDS AND A STUDY IS UNDERWAY TO DETERMINE THE SLUDGE DISPOSAL STRATEGY THAT WILL BE EMPLOYED.
CENTRAL ILLINOIS PUBLIC SERV NEWTON 1 NEW 617.0 MW (GROSS) 617.0 MW (ESC) COAL 4.00 %S BITUMINOUS DUAL ALKALI BUELL/ENVIROTECH ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 11/79	A CONTRACT HAS BEEN AWARDED BY CIPSO TO BUELL/ENVIROTECH FOR THE INSTALLATION OF AN EMISSION CONTROL SYSTEM ON UNIT 1. THE KEY COMPONENTS OF THE EMISSION CONTROL SYSTEM INCLUDE: A HIGH-EFFICIENCY ESP; FOUR PRECOOLERS, FOUR POLYSPHERE ABSORBERS, THREE THICKENERS, TWO EXPERIMENTAL REHEAT SYSTEMS, AND THREE HORIZONTAL EXTRACTION FILTERS FOR SLUDGE DEWATERING. MORE THAN 50 PERCENT OF THE CONSTRUCTION WORK AT THE PLANT HAS BEEN COMPLETED. THE FGD SYSTEM WILL HAVE CEILCOTE-LINED ABSORBER MODULES.
CENTRAL MAINE POWER SEARS ISLAND 1 NEW 600.0 MW (GROSS) 600.0 MW (ESC) COAL ***** %S LIME OR LIMESTONE VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 11/87	BECAUSE OF THE DISCOVERY OF A GEOLOGICAL FAULT ON SEARS ISLAND, THE UTILITY HAS CANCELLED PLANS FOR A 1150-MW NUCLEAR POWER PLANT. A 600-MW COAL FIRED UNIT IS NOW BEING PLANNED IN ITS PLACE. COMMERCIAL OPERATION IS PROJECTED FOR NOVEMBER 1986. COMPLIANCE WITH SO2 NSPS WILL BE ACHIEVED BY INSTALLING AN FGD SYSTEM. LIME AND LIMESTONE SCRUBBING PROCESSES ARE BEING GIVEN PRIMARY CONSIDERATION. CURRENTLY, CMPCO HAS FILED AN APPLICATION WITH THE STATE PUBLIC UTILITIES COMMISSION. A DELAY IN RECEIVING A PERMIT FROM THE MAINE PUBLIC UTILITIES COMMISSION HAS RESULTED IN A REVISED START-UP DATE OF NOVEMBER 1987.
CINCINNATI GAS & ELECTRIC EAST BEND 2 NEW 650.0 MW (GROSS) 650.0 MW (ESC) COAL 5.00 %S LIME BABCOCK & WILCOX ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 10/81	A CONTRACT HAS BEEN CONDITIONALLY AWARDED TO BABCOCK AND WILCOX FOR A COMMERCIAL LIME SCRUBBING SYSTEM. THE COAL SOURCE IS EXPECTED TO BE A WESTERN KENTUCKY COAL WITH A HIGH SULFUR CONTENT. THE THREE LIME SLURRY FGD MODULES WILL BE PRECEDED BY AN ESP FOR PARTICULATE CONTROL. A CONTRACT HAS BEEN CONDITIONALLY AWARDED TO IUCS FOR THE SLUDGE FIXATION. THE A-E FIRM IS SARGENT AND LUNDY. UNIT FOUNDATION HAS BEGUN AND FGD SYSTEM CONSTRUCTION WILL BEGIN IN EARLY 1979.
COLORADO UTE ELECTRIC ASSN. CRAIG 1 NEW 450.0 MW (GROSS) 450.0 MW (ESC) COAL .45 %S SUBBITUMINOUS LIMESTONE PEABODY PROCESS SYSTEMS ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 3/79	PEABODY PROCESS SYSTEMS HAS BEEN AWARDED A CONTRACT TO DESIGN AND SUPPLY A LIMESTONE SLURRY SPRAY TOWER ABSORBER SYSTEM FOR SO2 REMOVAL FROM LOW-SULFUR COAL-FIRED BOILER FLUE GAS FROM UNITS 1 AND 2. PARTICULATE CONTROL WILL BE PROVIDED BY HOT-SIDE ESP'S UPSTREAM OF THE ABSORBER SYSTEM. SLUDGE WILL BE STABILIZED AND HAULED TO A MINEFILL THERE WILL BE A STEAM COIL TYPE STACK GAS REHEATER INCLUDED. REQUIRED PARTICULATE AND SO2 REMOVAL EFFICIENCIES ARE 99.8 AND 85 PERCENT RESPECTIVELY. FGD CONSTRUCTION IS NOW 80% COMPLETE.
COLORADO UTE ELECTRIC ASSN. CRAIG 2 NEW 450.0 MW (GROSS) 450.0 MW (ESC) COAL .45 %S SUBBITUMINOUS LIMESTONE PEABODY PROCESS SYSTEMS ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 3/79	PEABODY PROCESS SYSTEMS HAS BEEN AWARDED A CONTRACT TO DESIGN AND SUPPLY A LIMESTONE SPRAY TOWER ABSORBER SYSTEM FOR SO2 REMOVAL FROM LOW-SULFUR COAL-FIRED BOILER FLUE GAS FROM UNITS 1 AND 2. PARTICULATE CONTROL WILL BE PROVIDED BY HOT-SIDE ESP'S UPSTREAM OF THE ABSORBER SYSTEM. SLUDGE WILL BE STABILIZED AND HAULED TO A MINEFILL. THERE WILL BE A STEAM COIL TYPE STACK GAS REHEATER INCLUDED. REQUIRED PARTICULATE AND SO2 REMOVAL EFFICIENCIES ARE 99.8 AND 85 PERCENT RESPECTIVELY. FGD CONSTRUCTION IS NOW 80% COMPLETE.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	ABSTRACT
COLUMBUS & SOUTHERN OHIO ELEC. CONESVILLE 5 NEW 411.0 MW (GROSS) 411.0 MW (ESC) COAL 4.67 %S BITUMINOUS LIME AIR CORRECTION DIVISION, UOP ENERGY CONSUMPTION: 3.9% STATUS 1 STARTUP 1/77	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE BOILER AND ESP WERE COMPLETED AND PLACED IN SERVICE IN SEPTEMBER 1976. THE B-SIDE MODULE BECAME AVAILABLE FOR SERVICE IN JANUARY 1977. COMMERCIAL OPERATIONS WERE ACHIEVED ON FEBRUARY 13, 1977. THE EMISSION CONTROL SYSTEM FOR THIS UNIT CONSISTS OF A COLD-SIDE ESP FOLLOWED BY TWO LIME TCA MODULES SUPPLIED BY UOP. DRAVO IS SUPPLING THE THIOSORBIC LIME REAGENT. IUCS IS SUPPLYING A POZ-O-TEC SLUDGE STABILIZATION FACILITY
COLUMBUS & SOUTHERN OHIO ELEC. CONESVILLE 6 NEW 411.0 MW (GROSS) 411.0 MW (ESC) COAL 4.67 %S BITUMINOUS LIME AIR CORRECTION DIVISION, UOP ENERGY CONSUMPTION: 3.9% STATUS 1 STARTUP 6/78	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. C&SOE SIGNED LONG TERM CONTRACTS WITH DRAVO FOR THE PURCHACE OF THIOSORBIC LIME AND WITH IUCS FOR A SLUDGE FIXATION SYSTEM. CONSTRUCTION COMMENCED IN 1977 AND WAS COMPLETED IN JANUARY 1978. SIMILAR TO UNIT 5, THIS MINE MOUTH PLANT BURNS COAL WITH 17% ASH AND 4.5 TO 4.9% SULFUR CONTENTS. THE DESIGN INCLUDES AN ESP UPSTREAM OF THE FGD SYSTEM FOR PARTICULATE CONTROL. THE FGD SYSTEM INCLUDES TWO LIME TCA MODULES FOR THE REMOVAL OF SO2.
COLUMBUS & SOUTHERN OHIO ELEC. POSTON 5 NEW 375.0 MW (GROSS) 375.0 MW (ESC) COAL 2.50 %S PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 0/83	THIS UNIT WILL BURN HIGH SULFUR OHIO COAL (APPROXIMATELY 2.5 PERCENT SULFUR CONTENT). THE DESIGN OF THE EMISSION CONTROL STRATEGY HAS NOT YET BEEN FINALIZED. THE PROCESS WILL EITHER BE LIME, LIMESTONE, OR DOUBLE ALKALI.
COLUMBUS & SOUTHERN OHIO ELEC. POSTON 6 NEW 375.0 MW (GROSS) 375.0 MW (ESC) COAL 2.50 %S PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 0/85	THIS UNIT WILL BURN HIGH SULFUR COAL (APPROXIMATELY 2.5 PERCENT SULFUR CONTENT). THE DESIGN OF THE EMISSION CONTROL STRATEGY FOR THIS UNIT HAS NOT YET BEEN FINALIZED.
COMMONWEALTH EDISON POWERTON 51 RETROFIT 450.0 MW (GROSS) 425.0 MW (ESC) COAL 3.60 %S LIMESTONE AIR CORRECTION DIVISION, UOP ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 7/79	THE AIR CORRECTION DIVISION OF UOP WAS AWARDED THE CONTRACT FOR A WET LIMESTONE SYSTEM THAT WILL BE BACKFITTED ON TO BOILER NO. 51, ONE OF TWO IDENTICAL BOILERS SUPPLING STEAM TO AN 850-MW TURBINE-GENERATOR. THE SLUDGE WILL BE STABILIZED AND HAULED TO A LANDFILL. REHEAT WILL BE PROVIDED BY A STEAM COIL WHICH WILL HEAT THE AMBIENT AIR THAT IS PUMPED INTO THE SCRUBBER OUTLET BEFORE THE FLUE GAS ENTERS THE STACK. THE SO2 EMISSION STANDARD IS 1.8 LB. SO2/MM BTU. CONSTRUCTION IS ABOUT 80% COMPLETE.
COOPERATIVE POWER ASSOCIATION COAL CREEK 1 NEW 545.0 MW (GROSS) 327.0 MW (ESC) COAL .63 %S LIGNITE LIME COMBUSTION ENGINEERING ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 5/79	THIS UNIT IS UNDER THE COMBINED OWNERSHIP OF COOP POWER AND UNITED POWER. A CONTRACT HAS BEEN AWARDED TO COMBUSTION ENGINEERING FOR THE INSTALLATION OF LIME FGD SYSTEMS ON UNITS 1 AND 2 AT THIS STATION. THE FGD SYSTEM FOR EACH BOILER WILL CONSIST OF FOUR SPRAY TOWER ABSORBER MODULES FOR SO2 REMOVAL. ELECTROSTATIC PRECIPITATORS WILL BE INSTALLED UPSTREAM OF EACH ABSORBER TRAIN. CONSTRUCTION BEGAN EARLY IN AUGUST 1977. THE UNIT IS NOW 85-90% COMPLETE. BAD WINTER WEATHER SLOWED CONSTRUCTION SLIGHTLY.

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STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	ABSTRACT
COOPERATIVE POWER ASSOCIATION COAL CREEK 2 NEW 545.0 MW (GROSS) 327.0 MW (ESC) COAL .63 %S LIGNITE LIME COMBUSTION ENGINEERING ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 10/80	THIS UNIT IS UNDER THE COMBINED OWNERSHIP OF COOP POWER AND UNITED POWER. A CONTRACT HAS BEEN AWARDED TO COMBUSTION ENGINEERING FOR THE INSTALLATION OF LIME FGD SYSTEMS ON UNITS 1 AND 2 AT THIS STATION. THE FGD SYSTEM FOR EACH BOILER WILL CONSIST OF FOUR SPRAY TOWER ABSORBER MODULES FOR SO2 REMOVAL. ELECTROSTATIC PRECIPITATORS WILL BE INSTALLED UPSTREAM OF EACH ABSORBER TRAIN. CONSTRUCTION BEGAN EARLY IN AUGUST 1977 AND THE UNIT IS NOW 45% COMPLETE. THERE HAVE BEEN MINOR DELAYS BUT START-UP IS STILL SCHEDULED FOR NOVEMBER 1979.
DELMARVA POWER & LIGHT DELAWARE CITY 1-3 RETROFIT 180.0 MW (GROSS) 180.0 MW (ESC) COKE 7.50 %S COKE WELLMAN LORD DAVY POWERGAS ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 4/80	DELMARVA'S DELAWARE CITY PLANT HAS 4 BOILERS, 3 OF WHICH HAVE STEAM CAPACITIES OF 500K LBS/HR EACH. THE BOILERS GENERATE STEAM AS WELL AS ELECTRICAL POWER FOR GETTY REFINING & MARKETING. 7-8% S COKE WILL BE BURNED IN THE BOILERS (INSTEAD OF THE LOW-S CRUDE OIL NOW BURNED) WHEN THE CONTROL SYSTEM GOES INTO OPERATION IN APRIL 1980. DELMARVA WILL USE VENTURI SCRUBBERS FOR PARTICULATE REMOVAL AND WELLMAN-LORD FGD SYSTEMS AT EACH BOILER GAS EXIT FOR SO2 CONTROL. DESIGN PARTICULATE AND SO2 REMOVAL EFFICIENCIES ARE 90 AND 85-90 PERCENT RESPECTIVELY. CONSTRUCTION IS 38% COMPLETE.
DUQUESNE LIGHT ELRAMA 1-4 RETROFIT 510.0 MW (GROSS) 510.0 MW (ESC) ***** %S LIME CHEMICO ENERGY CONSUMPTION: 3.5% STATUS 1 STARTUP 10/75	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE FGD SYSTEM ON THIS 4-BOILER UNIT CONSISTS OF FIVE COMMON-HEADERED SINGLE STAGE VENTURI SCRUBBER-ABSORBERS DOWNSTREAM FROM A MECHANICAL COLLECTOR-ESP PARTICULATE REMOVAL SYSTEM. THE PLANT BURNS COAL WITH A HEATING VALVE OF 11,000 BTU/LB AND SULFUR AND ASH CONTENTS OF 1.8 TO 2.2% AND 21% RESPECTIVELY. DEWATERED SLUDGE FROM THE IUCS PLANT IS HAULED TO AN OFF-SITE LANDFILL. THE SYSTEM INCLUDES A DIRECT OIL-FIRED STACK GAS REHEAT SYSTEM. DESIGNED REMOVAL EFFICIENCIES ARE 99% (PART) AND 83% (SO2).
DUQUESNE LIGHT PHILLIPS 1-6 RETROFIT 410.0 MW (GROSS) 410.0 MW (ESC) COAL 2.00 %S LIME CHEMICO ENERGY CONSUMPTION: 2.4% STATUS 1 STARTUP 7/73	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE FGD SYSTEM ON THIS 6-BOILER UNIT CONSISTS OF ONE 2-STAGE AND THREE SINGLE STAGE VENTURI SCRUBBER-ABSORBERS DOWNSTREAM FROM A MECHANICAL COLLECTOR-ESP PARTICULATE REMOVAL SYSTEM. THE PLANT BURNS COAL WITH A HEATING VALVE OF 11,000 BTU/LB AND SULFUR AND ASH CONTENTS OF 1.8 TO 2.2% AND 21% RESPECTIVELY. DEWATERED SLUDGE FROM THE IUCS PLANT IS HAULED TO AN OFF-SITE LANDFILL. THE SYSTEM INCLUDES A DIRECT OIL-FIRED STACK GAS REHEAT SYSTEM. DESIGNED REMOVAL EFFICIENCIES ARE 99%(PART) AND 83%(SO2).
EAST KENTUCKY POWER COOP SPURLOCK 2 NEW 500.0 MW (GROSS) 500.0 MW (ESC) COAL 3.50 %S LIME ADL/COMBUSTION EQUIP ASSOCIATE ENERGY CONSUMPTION: ****% STATUS 3 STARTUP 3/80	A CONTRACT HAS BEEN AWARDED TO ADL/COMBUSTION EQUIPMENT ASSOCIATES FOR A LIME SLURRY FGD SYSTEM ON THE NEW 500-MW UNIT SPURLOCK 2. PARTICULATES WILL BE CONTROLLED BY A 99.5% EFFICIENT ESP. COOLING TOWER BLOWDOWN WILL BE USED AS THE MAKE-UP WATER SOURCE FOR THE FGD SYSTEM. THE DESIGN SO2 REMOVAL EFFICIENCY IS 90%. THE SYSTEM IS NOW IN THE DESIGN PHASE.
GENERAL PUBLIC UTILITIES COHO 1 NEW 800.0 MW (GROSS) 800.0 MW (ESC) COAL 3.50 %S PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 5/88	STARTUP DATE WAS CHANGED TO 5/88 FOR BOTH BOILER AND DESULFURIZATION SYSTEM. LIME AND LIMESTONE SCRUBBING ARE THE PRIMARY STRATEGIES BEING CONSIDERED FOR COMPLIANCE WITH NEW SOURCE PERFORMANCE STANDARDS. NO DECISION HAS BEEN MADE YET, ALTHOUGH A SLURRY TYPE SYSTEM IS NOT CONTEMPLATED.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	ABSTRACT
GENERAL PUBLIC UTILITIES SEWARD 7 NEW 800.0 MW (GROSS) 800.0 MW (ESC) COAL ***** %S PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 5/85	STARTUP DATE WAS CHANGED TO 5/85 FOR BOTH BOILER AND DESULFURIZATION SYSTEM. LIME AND LIMESTONE SCRUBBING ARE THE PRIMARY STRATEGIES BEING CONSIDERED FOR COMPLIANCE WITH THE NEW SOURCE PERFORMANCE STANDARDS. NO DECISION HAS BEEN MADE YET, ALTHOUGH A SLURRY TYPE WILL NOT BE USED.
GULF POWER SCHOLZ 1,2 RETROFIT 23.0 MW (GROSS) 23.0 MW (ESC) COAL 2.50 %S BITUMINOUS LIMESTONE (CHIYODA 121) CHIYODA INTERNATIONAL ENERGY CONSUMPTION: ****% STATUS 1 STARTUP 8/78	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. CHIYODA INTERNATIONAL SUPPLIED THIS 23 MW PROTOTYPE UNIT WHICH BEGAN OPERATION ON AUGUST 30, 1978. THE CT-121 SYSTEM INCLUDES A NEWLY DEVELOPED JET BUBBLING REACTOR WHICH FEATURES A LARGE GAS-LIQUID INTERFACIAL AREA AND PROVIDES PARTICULATE AS WELL AS SO2 REMOVAL. MIST ELIMINATION IS PROVIDED BY A DOUBLE PASS VERTICAL CHEVRON. GYPSUM IS PRODUCED AND STACKED IN THE EXISTING POND. THE STACKING CAPABILITIES OF THE GYPSUM ARE BEING TESTED, ALONG WITH THE GROUND WATER NEAR THE STACK SITE TO CHECK FOR LEACHING.
HOOSIER ENERGY MEROM 1 NEW 490.0 MW (GROSS) 441.0 MW (ESC) COAL 3.50 %S LIMESTONE MITSUBISHI INTERNATIONAL ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 4/81	HOOSIER ENERGY AWARDED A CONTRACT TO MITSUBISHI INTERNATIONAL CORP. FOR TWO LIMESTONE FGD SYSTEMS FOR MEROM 1 AND 2. THE NEW 490 MW COAL-FIRED UNITS ARE PLANNED FOR LOCATION IN SULLIVAN, INDIANA. THE FLUE GAS STREAMS WILL BE CLEANED OF PARTICULATE WITH ESP'S (99.4%) AND OF SULFUR DIOXIDE WITH GRID-TOWER ABSORBERS (90%). SLUDGE WILL BE STABILIZED AND STOCKPILED. THE GROUND WAS BROKEN FOR CONSTRUCTION IN NOVEMBER 1977. BOILER STRUCTURAL STEEL IS NOW BEING ERECTED AND FGD FOOTINGS ARE IN PLACE
HOOSIER ENERGY MEROM 2 NEW 490.0 MW (GROSS) 441.0 MW (ESC) COAL 3.50 %S LIMESTONE MITSUBISHI INTERNATIONAL ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 1/82	HOOSIER ENERGY AWARDED A CONTRACT TO MITSUBISHI INTERNATIONAL CORP. FOR TWO LIMESTONE FGD SYSTEMS FOR MEROM 1 AND 2. THE NEW 490 MW COAL-FIRED UNITS ARE PLANNED FOR LOCATION IN SULLIVAN, INDIANA. THE FLUE GAS STREAMS WILL BE CLEANED OF PARTICULATE WITH ESP'S (99.4%) AND OF SULFUR DIOXIDE WITH GRID-TOWER ABSORBERS (90%). SLUDGE WILL BE STABILIZED AND STOCKPILED. THE GROUND WAS BROKEN FOR CONSTRUCTION IN NOVEMBER 1977, BUT DUE TO THE BAD WINTER WEATHER, CONSTRUCTION WAS DELAYED. THE BOILER IS ESSENTIALLY COMPLETE. STARTUP IS EXPECTED SHORTLY.
HOUSTON LIGHTING & POWER CO. W.A. PARISH 8 NEW 550.0 MW (GROSS) 512.0 MW (ESC) COAL .60 %S LIMESTONE VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 5 STARTUP 10/82	HL&P WILL BE INSTALLING AN FGD SYSTEM ON THE UTILITY'S 600 MW W. A.-PARISH 8 UNIT. PARTICUALTE MATTER WILL BE CONTROLLED BY BAGHOUSE UP-STREAM OF THE LIMESTONE SLURRY FGD SYSTEM. THE FGD SYSTEM WILL BE DESIGNED TO REMOVE SO2 WITH AN EFFICIENCY OF GREATER THAN 83%. REHEAT WILL BE PROVIDED BY BY-PASSING 7% OF THE PARTICULATE CLEANED GAS. SLUDGE WILL BE DEWATERED, BLENDED WITH FLYASH AND DISPOSED IN AN ON SITE LANDFILL. INITIAL STARTUP IS SCHEDULED FOR FALL, 1982.
INDIANAPOLIS POWER & LIGHT PETERSBURG 3 NEW 532.0 MW (GROSS) 532.0 MW (ESC) COAL 3.25 %S BITUMINOUS LIMESTONE AIR CORRECTION DIVISION, UOP ENERGY CONSUMPTION: 2.4% STATUS 1 STARTUP 12/77	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE WET LIMESTONE FGD SYSTEM INSTALLED ON THIS UNIT WAS SUPPLIED BY THE AIR CORRECTION DIVISION OF UOP. UNIT 3 FIRES BITUMINOUS COAL HAVING A SULFUR CONTENT OF 1.5-4.5%, AN ASH CONTENT OF 9-10% AND A 11,000 BTU/LB VALUE. TWO ESPS PROVIDE PRIMARY PARTICULATE CONTROL UPSTREAM OF A FOUR-MODULE TCA FGD SYSTEM. STABILIZED SLUDGE IS DISPOSED ON AN ON-SITE POND. THE DESIGN INCLUDES AN INDIRECT STEAM TUBE REHEAT SYSTEM. SHAKE DOWN AND DEBUGGING OPERATIONS ARE STILL PROCEEDING.

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STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	ABSTRACT
INDIANAPOLIS POWER & LIGHT PETERSBURG 4 NEW 530.0 MW (GROSS) 530.0 MW (ESC) COAL 3.50 %S BITUMINOUS LIMESTONE RESEARCH COTTRELL ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 10/83	INDIANAPOLIS POWER & LIGHT AWARDED A CONTRACT TO RESEARCH COTTRELL FOR A LIME STONE FGD SYSTEM. SO2 REMOVAL EFFICIENCY WILL BE APPROXIMATELY 80 PERCENT. THIS NEW UNIT WILL FIRE HIGH-SULFUR BITUMINOUS COAL WITH A HEATING VALUE OF 11,000 BTU/LB AND ASH AND SULFUR CONTENTS OF 10 PERCENT AND 3.5 PERCENT, RESPECTIVELY. SLUDGE WILL BE DEWATERED AND MIXED WITH FLYASH TO PRODUCE A DRY STABILIZED PRODUCT. EXCAVATION, FOUNDATION WORK AND SOME STEEL WORK IS NOW IN PROGRESS ON THE UNIT.
KANSAS CITY POWER & LIGHT HAWTHORN 3 RETROFIT 110.0 MW (GROSS) 110.0 MW (ESC) COAL .60 %S BITUMINOUS LIME COMBUSTION ENGINEERING ENERGY CONSUMPTION: 1.8% STATUS 1 STARTUP 11/72	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE SCRUBBER-ABSORBER SYSTEM ON THIS UNIT WAS CONVERTED FROM A LIMESTONE FURNACE INJECTION AND TAIL-END SYSTEM TO A TAIL-END LIME SLURRY SYSTEM. OPERATION IN THE LIME SCRUBBING MODE COMMENCED ON JANUARY 1, 1977. COMPLIANCE TEST INDICATED THE UNIT MEETS THE KANSAS CITY 0.17 LB/MM BTU PARTICULATE REG. FGD SYSTEM DESIGN INCLUDES A FINNED-TUBE STEAM REHEATER, AN ON-SITE UNLINED SLUDGE DISPOSAL POND, AND A CHEVRON MIST ELIMINATOR SYSTEM. THE 2 FGD MODULES CAN BE BY-PASSED IN EMERGENCIES.
KANSAS CITY POWER & LIGHT HAWTHORN 4 RETROFIT 110.0 MW (GROSS) 110.0 MW (ESC) COAL .60 %S BITUMINOUS LIME COMBUSTION ENGINEERING ENERGY CONSUMPTION: 1.8% STATUS 1 STARTUP 8/72	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE SCRUBBER-ABSORBER SYSTEM ON THIS UNIT WAS CONVERTED FROM A LIMESTONE FURNACE INJECTION AND TAIL-END SYSTEM TO A TAIL-END LIME SLURRY SYSTEM. OPERATION IN THE LIME SCRUBBING MODE COMMENCED ON JANUARY 1, 1977. COMPLIANCE TEST INDICATED THE UNIT MEETS THE KANSAS CITY 0.17 LB/MM BTU PARTICULATE REG. FGD SYSTEM DESIGN INCLUDES A FINNED-TUBE STEAM REHEATER, AN ON-SITE UNLINED SLUDGE DISPOSAL POND, AND A CHEVRON ELIMINATOR SYSTEM. THE 2 FGD MODULES CAN BE BY-PASSED IN EMERGENCIES.
KANSAS CITY POWER & LIGHT LA CYGNE 1 NEW 874.0 MW (GROSS) 874.0 MW (ESC) COAL 5.39 %S SUBBITUMINOUS LIMESTONE BABCOCK & WILCOX ENERGY CONSUMPTION: 2.7% STATUS 1 STARTUP 2/73	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE EMISSION CONTROL SYSTEM FOR THIS NEW COAL-FIRED POWER-GENERATING UNIT CONSISTS OF EIGHT SCRUBBER MODULES FOR FLY ASH AND SO2 REMOVAL. EACH MODULE INCLUDES A VENTURI SCRUBBER IN SERIES WITH A 2-STAGE IMPINGEMENT PLATE ABSORBER. THE SCRUBBER PLANT IS AN INTEGRAL PART OF THE POWER-GENERATING COMPLEX, ALLOWING NO FLUE GAS BYPASS. INITIAL OPERATIONS COMMENCED IN FEB. 1973. COMMERCIAL SERVICE WAS ATTAINED BY JUNE 1973.
KANSAS POWER & LIGHT JEFFREY 1 NEW 720.0 MW (GROSS) 540.0 MW (ESC) COAL .32 %S LIMESTONE COMBUSTION ENGINEERING ENERGY CONSUMPTION: ****% STATUS 1 STARTUP 8/78	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. COMBUSTION ENGINEERING SUPPLIED THE LIMESTONE EMISSION CONTROL SYSTEM FOR THIS NEW COAL FIRED UNIT. THE UNIT CONSISTS OF A COLD-SIDE ESP AND SPRAY TOWERS FOR THE CONTROL OF SO2 AND PARTICULATE EMISSIONS. 30% OF THE FLUE GAS IS BYPASSED FOR REHEAT. NOX EMISSIONS ARE CONTROLLED BY AN AIR OVERFIRE SYSTEM AT THE TANGENTIALLY FIRED PULVERIZED BUNKERS. THE CLEANED GASES ARE VENTED TO A 600 FT STACK. SLUDGE IS MIXED WITH BOTTOM ASH AND DISPOSED OF IN THE EXISTING ON-SITE BOTTOM ASH POND.
KANSAS POWER & LIGHT JEFFREY 2 NEW 700.0 MW (GROSS) 490.0 MW (ESC) COAL .30 %S LIMESTONE COMBUSTION ENGINEERING ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 6/80	COMBUSTION ENGINEERING IS SUPPLYING THE EMISSION CONTROL SYSTEM FOR THIS NEW COAL FIRED UNIT. THE SYSTEM WILL CONSIST OF A COLD-SIDE ESP AND SPRAY TOWERS FOR THE CONTROL OF PARTICULATE AND SO2 EMISSIONS. 30% OF THE FLUE GAS WILL BE BYPASSED FOR REHEAT. AN OVERFIRE AIR SYSTEM AT THE TANGENTIAL FIRED PULVERIZED BURNERS WILL CONTROL NOX EMISSIONS. THE CLEANED GASES WILL BE VENTED TO A 600 FT STACK. SLUDGE WILL BE MIXED WITH BOTTOM ASH AND DISPOSED ON-SITE IN THE BOTTOM ASH POND. THE SYSTEM STEEL WORK IS UP AND CONSTRUCTION IS APPROXIMATELY 60% COMPLETE.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	ABSTRACT
KANSAS POWER & LIGHT LAWRENCE 4 RETROFIT 125.0 MW (GROSS) 125.0 MW (ESC) COAL .55 %S LIMESTONE COMBUSTION ENGINEERING ENERGY CONSUMPTION: ****% STATUS 1 STARTUP 1/76	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE NEW LIMESTONE FGD SYSTEM COMMENCED OPERATIONS IN EARLY JANUARY 1977. THE NEW SYSTEM REPLACED MARBLE-BED TOWERS WITH SPRAY TOWERS. THERE HAVE BEEN NO FORCED SCRUBBER OUTAGES REPORTED SINCE START-UP. CONTINUOUS SO2 MONITORS HAVE RECORDED SO2 REMOVAL EFFICIENCIES OF BETTER THAN 85%. THE UTILITY REPORTED PARTICULATE REMOVAL IS SUCH THAT NO VISIBLE PLUME EXITS THE STACK. THE PLANT IS FIRING COAL RATED AT 10,000 BTU/LB WITH A SULFUR CONTENT OF 0,5%
KANSAS POWER & LIGHT LAWRENCE 5 RETROFIT 420.0 MW (GROSS) 420.0 MW (ESC) COAL .55 %S LIMESTONE COMBUSTION ENGINEERING ENERGY CONSUMPTION: ****% STATUS 1 STARTUP 11/71	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE ORIGINAL LIMESTONE INJECTION AND TAIL-END SCRUBBING SYSTEM WAS SHUT DOWN ON MARCH 20 SO THAT THE NEW ROD-SCRUBBER AND SPRAY TOWER ABSORBER SYSTEM COULD BE TIED INTO THE UNIT. THE NEW SYSTEM, WHICH INCLUDES TWO MODULES, EACH CAPABLE OF HANDLING APPROXIMATELY 50 PERCENT OF THE TOTAL BOILER FLUE GAS FLOW, CAME ON LINE APRIL 14, 1978. THE SYSTEM DESIGNER AND SUPPLIER WAS COMBUSTION ENGINEERING. THE UNIT FIRES LOW SULFUR WYOMING COAL WITH A HEAT CONTENT OF 10,000 BTU/LB.
KENTUCKY UTILITIES GREEN RIVER 1-3 RETROFIT 64.0 MW (GROSS) 64.0 MW (ESC) COAL 4.00 %S BITUMINOUS LIME AMERICAN AIR FILTER ENERGY CONSUMPTION: 3.1% STATUS 1 STARTUP 9/75	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE SCRUBBER PLANT INSTALLED AT THIS STATION CONSISTS OF ONE MODULE DESIGNED TO REMOVE PARTICULATE (VARIABLE-THROAT VENTURI) AND SO2 (MOBILE -BED CONTACTOR) FROM COAL-FIRED BOILER FLUE GAS. THE SCRUBBER WAS DESIGNED AND SUPPLIED BY AAF. SLUDGE IS DISPOSED IN AN ON-SITE UNLINED POND. THE COAL BURNED HAS SULFUR AND ASH CONTENTS OF 4.0 AND 11% RESPECTIVELY AND A MOISTURE CONTENT OF 6-10 PERCENT. INITIAL STARTUP OCCURRED IN SEPTEMBER 1975. COMMERCIAL OPERATION BEGAN IN JANUARY 1976.
LAKELAND UTILITIES MCINTOSH 3 NEW 364.0 MW (GROSS) 364.0 MW (ESC) COAL 2.56 %S BITUMINOUS LIMESTONE BABCOCK & WILCOX ENERGY CONSUMPTION: ****% STATUS 3 STARTUP 10/81	THE CITY OF LAKELAND DEPARTMENT OF ELECTRIC AND WATER UTILITIES AWARDED A CONTRACT TO B&W FOR AN EMISSION CONTROL SYSTEM ON THE UTILITY'S NEW 350-MW POWER GENERAGING UNIT, MCINTOSH 3. THE UNIT WILL UTILIZE COLD SIDE ESP'S FOR PARTICULATE REMOVAL AND TWO LIMESTONE SCRUBBER ABSORBER MODULES. START-UP IS SCHEDULED FOR OCTOBER 1981. THE COAL WILL CONTAIN ABOUT 2.5% SULFUR. THE UNIT DESIGN INCLUDES A REHEAT AND AN IUCS SLUDGE DISPOSAL SYSTEM. SITE EXCAVATION HAS BEGUN.
LOUISVILLE GAS & ELECTRIC CANE RUN 4 RETROFIT 190.0 MW (GROSS) 190.0 MW (ESC) COAL 3.75 %S LIME AMERICAN AIR FILTER ENERGY CONSUMPTION: 1.6% STATUS 1 STARTUP 8/76	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE FGD SYSTEM RETROFITTED ON THIS BOILER WAS DESIGNED AND SUPPLIED BY AMERICAN AIR FILTER AND WAS FIRST PLACED IN THE GAS PATH ON AUGUST 7, 1976. THE SYSTEM CONSISTS OF TWO PARALLEL MODULES WHICH INCLUDE MOBILE BED CONTACTORS AND OPERATE WITH A CARBIDE LIME ADDITIVE. FOLLOWING A NUMBER OF MAJOR SYSTEM MODIFICATIONS (CHEVRON-TYPE MIST ELIMINATOR, OIL FIRED REHEAT, PLASITE DUCT LINER, HIGHER L/G), THE SYSTEM SUCCESSFULLY PASSED COMPLIANCE TESTING (85% SO2 REMOVAL) ON AUGUST 3 AND 4, 1977.
LOUISVILLE GAS & ELECTRIC CANE RUN 5 RETROFIT 200.0 MW (GROSS) 200.0 MW (ESC) COAL 3.75 %S BITUMINOUS LIME COMBUSTION ENGINEERING ENERGY CONSUMPTION: 1.5% STATUS 1 STARTUP 12/77	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE FGD SYSTEM FOR THIS UNIT WAS DESIGNED AND SUPPLIED BY COMBUSTION ENGINEERING. IT CONSISTS OF TWO SPRAY TOWER ABSORBERS FOR FULL-LOAD SO2 REMOVAL AND UTILIZES CARBIDE LIME AS THE ABSORBING REAGENT. IN-LINE STEAM REHEAT, A COMMON REACTION TANK, AND A THICKENER FOR SOLIDS DEWATERING ARE INCLUDED. AN EXISTING UPSTREAM ESP PROVIDES PRIMARY PARTICULATE CONTROL. THE FGD SYSTEM BEGAN INITIAL OPERATION IN DEC. 1977 BUT A COAL STRIKE FORCED A PLANT SHUTDOWN. THE SYSTEM WAS RE-STARTED MARCH 24, 1978.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	ABSTRACT
LOUISVILLE GAS & ELECTRIC CANE RUN 6 RETROFIT 278.0 MW (GROSS) 278.0 MW (ESC) COAL 3.75 %S DUAL ALKALI ADL/COMBUSTION EQUIP ASSOCIATE ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 3/79	THE CONTRACT FOR THIS FULL-SCALE DEMONSTRATION FGD SYSTEM HAS BEEN AWARDED TO A.D. LITTLE/COMBUSTION EQUIPMENT ASSOC. FOR THE INSTALLATION OF A DOUBLE ALKALI SYSTEM. THE FEDERAL EPA WILL SUBSIDIZE A MAXIMUM $4.5 MM FOR OPERATION, RESEARCH AND DEVELOPMENT, AND REPORT WRITING FOR A ONE-YEAR PERIOD FOLLOWING THE FIRST THREE MONTHS OF OPERATIONS (NOTE: THIS SUBSIDY WILL NOT BE APPLIED FOR ANY CAPITAL EXPENDITURES). CONSTRUCTION AT THIS UNIT IS ESSENTIALLY COMPLETE.
LOUISVILLE GAS & ELECTRIC MILL CREEK 1 RETROFIT 350.0 MW (GROSS) 350.0 MW (ESC) COAL 3.75 %S LIME/LIMESTONE COMBUSTION ENGINEERING ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 4/81	A COMPLIANCE SCHEDULE WAS SUBMITTED TO THE JEFFERSON COUNTY AIR POLLUTION CONTROL DISTRICT WITH 4/81 ESTABLISHED AS THE STARTUP DATE FOR AN FGD SYSTEM. OPERATING DATA AND INFORMATION FROM THE FULL-SCALE SCRUBBER PLANT NOW IN SERVICE ON THE NO. 4 UNIT AT CANE RUN WILL BE OBTAINED BEFORE THE UTILITY PROCEEDS WITH ADDITIONAL SYSTEM DESIGN WORK. A CONTRACT WAS AWARDED TO COMBUSTION ENGINEERING FOR A LIME/LIMESTONE FGD SYSTEM.
LOUISVILLE GAS & ELECTRIC MILL CREEK 2 RETROFIT 350.0 MW (GROSS) 350.0 MW (ESC) COAL 3.75 %S LIME/LIMESTONE COMBUSTION ENGINEERING ENERGY CONSUMPTION: ****% STATUS 3 STARTUP 4/82	A COMPLIANCE SCHEDULE WAS SUBMITTED TO THE JEFFERSON COUNTY AIR POLLUTION CONTROL DISTRICT WITH 4/82 ESTABLISHED AS THE STARTUP DATE FOR AN FGD SYSTEM. OPERATING DATA AND INFORMATION FROM THE FULL-SCALE SCRUBBER PLANT NOW IN SERVICE ON THE NO. 4 UNIT AT CANE RUN WILL BE OBTAINED BEFORE THE UTILITY PROCEEDS WITH ADDITIONAL SYSTEM DESIGN WORK. A CONTRACT WAS AWARDED TO COMBUSTION ENGINEERING FOR A LIME/LIMESTONE FGD SYSTEM.
LOUISVILLE GAS & ELECTRIC MILL CREEK 3 NEW 425.0 MW (GROSS) 425.0 MW (ESC) COAL 3.75 %S BITUMINOUS LIME AMERICAN AIR FILTER ENERGY CONSUMPTION: ****% STATUS 1 STARTUP 8/78	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE SYSTEM WAS DESIGNED AND SUPPLIED BY AAF AND UTILIZES CARBIDE LIME AS THE ABSORBENT. FOUR MOBILE-BED ABSORBERS TREAT THE FLUE GAS RESULTING FROM THE COMBUSTION OF HIGH-SULFUR COAL. THE SYSTEM OPERATES IN AN OPEN WATER LOOP. THE SCRUBBING WASTE IS STABILIZED WITH FLYASH AND LIME. THE UNIT BECAME OPERATIONAL ON AUGUST 13, 1978.
LOUISVILLE GAS & ELECTRIC MILL CREEK 4 NEW 495.0 MW (GROSS) 495.0 MW (ESC) COAL 3.75 %S LIME AMERICAN AIR FILTER ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 7/81	BECAUSE POWER DEMAND HAS NOT COME UP AS RAPIDLY AS HAD BEEN EXPECTED, UNIT START-UP HAS BEEN MOVED BACK TO JULY 1981. CONSTRUCTION OF THIS NEW 495-MW COAL-FIRED UNIT IS ON SCHEDULE. CURRENTLY, FOUNDATION WORK IS IN PROGRESS. THIS AAF SYSTEM WILL INCLUDE MOBILE-BED ABSORBERS TREATING HIGH SULFUR COAL FLUE GAS. THE SYSTEMS WATER LOOP WILL BE CLOSED. THE SLUDGE WILL BE STABILIZED WITH LIME AND FLYASH. STEAM REHEAT WILL PROVIDE GAS TEMPERATURE ELEVATION OF THE SCRUBBED GASES PRIOR TO DISCHARGE TO THE MAIN STACK.
LOUISVILLE GAS & ELECTRIC PADDY'S RUN 6 RETROFIT 70.0 MW (GROSS) 70.0 MW (ESC) COAL 2.50 %S LIME COMBUSTION ENGINEERING ENERGY CONSUMPTION: 1.4% STATUS 1 STARTUP 4/73	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THIS SCRUBBING SYSTEM WAS DESIGNED BY COMBUSTION ENGINEERING AND PLACED IN SERVICE IN APRIL 1973. THE FGD SYSTEM CONSISTS OF TWO 2-STAGE MARBLE BED ABSORBERS WHICH ARE DESIGNED TO USE CARBIDE LIME ADDITIVE AS THE SCRUBBING REAGENT. PADDYS RUN NO. 6 IS A PEAK-LOAD UNIT THAT OPERATES ONLY DURING DEMAND PERIODS. AN EXTENSIVE EPA SCRUBBER/SLUDGE EVALUATION STUDY WAS COMPLETED IN AUGUST 1977. THIS UNIT WILL BE RETIRED WHEN MILL CREEK 3 BECOMES FULLY OPERATIONAL.

UNIT IDENTIFICATION	ABSTRACT
LOUISVILLE GAS & ELECTRIC TRIMBLE COUNTY 1 NEW 575.0 MW (GROSS) 575.0 MW (ESC) COAL 4.00 %S BITUMINOUS PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 7/84	LG&E WILL BE INSTALLING FGD SYSTEMS ON TWO OF THE UTILITY'S TRIMBLE COUNTY UNITS. THE 575-MW UNITS WILL BURN COAL WITH AN AVERAGE 4% SULFUR CONTENT (IF NO COAL WASH IS INCLUDED). PARTICULATE MATTER WILL BE CONTROLLED BY ESP'S AND SO2 WILL BE CONTROLLED BY WET SCRUBBING (90% REMOVAL EFFICIENCY). SLUDGE DISPOSAL STRATEGY IS AS YET, UNDECIDED. START-UP IS SCHEDULED FOR JULY 1984 AND 1986 RESPECTIVELY.
LOUISVILLE GAS & ELECTRIC TRIMBLE COUNTY 2 NEW 575.0 MW (GROSS) 575.0 MW (ESC) COAL 4.00 %S BITUMINOUS PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 0/84	LG&E WILL BE INSTALLING FGD SYSTEMS ON TWO OF THE UTILITY'S TRIMBLE COUNTY UNITS. THE 575-MW UNITS WILL BURN COAL WITH AN AVERAGE 4% SULFUR CONTENT (IF NO COAL WASH IS INCLUDED). PARTICULATE MATTER WILL BE CONTROLLED BY ESP'S AND SO2 WILL BE CONTROLLED BY WET SCRUBBING (90% REMOVAL EFFICIENCY). SLUDGE DISPOSAL STRATEGY IS AS YET, UNDECIDED. START-UP IS SCHEDULED FOR JULY 1984 AND 1986 RESPECTIVELY.
MIDDLE SOUTH UTILITIES ARKANSAS COAL 5 NEW 890.0 MW (GROSS) 890.0 MW (ESC) COAL .50 %S PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 5 STARTUP 1/86	A CONTRACT HAS BEEN AWARDED FOR BOILERS AND TURBINES ON SIX NEW MIDDLE SOUTH UTILITIES UNITS. THE UTILITY IS CURRENTLY REQUESTING/EVALUATING BIDS FOR THE FGD INSTALLATIONS ALTHOUGH THE TYPE OF FGD SYSTEM HAS NOT YET BEEN DETERMINED.
MIDDLE SOUTH UTILITIES ARKANSAS COAL 6 NEW 890.0 MW (GROSS) 890.0 MW (ESC) COAL .50 %S PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 5 STARTUP 1/88	A CONTRACT HAS BEEN AWARDED FOR BOILERS AND TURBINES ON SIX NEW MIDDLE SOUTH UTILITIES UNITS. THE UTILITY IS CURRENTLY REQUESTING/EVALUATING BIDS FOR THE FGD INSTALLATIONS ALTHOUGH THE TYPE OF FGD SYSTEM HAS NOT YET BEEN DETERMINED.
MIDDLE SOUTH UTILITIES LOUISIANA COAL 1 NEW 890.0 MW (GROSS) 890.0 MW (ESC) COAL .50 %S PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 5 STARTUP 0/86	A CONTRACT HAS BEEN AWARDED FOR BOILERS AND TURBINES ON SIX NEW MIDDLE SOUTH UTILITIES UNITS. THE UTILITY IS CURRENTLY REQUEST/EVALVATING BIDS FOR THE FGD INSTALLATIONS ALTHOUGH THE TYPE OF FGD SYSTEM HAS NOT YET BEEN DETERMINED.
MIDDLE SOUTH UTILITIES LOUISIANA COAL 2 NEW 890.0 MW (GROSS) 890.0 MW (ESC) COAL .50 %S PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 5 STARTUP 0/88	A CONTRACT HAS BEEN AWARDED FOR BOILERS AND TURBINES ON SIX NEW MIDDLE SOUTH UTILITIES UNITS. THE UTILITY IS CURRENTLY REQUESTING/EVALUATING BIDS FOR THE FGD INSTALLATIONS ALTHOUGH THE TYPE OF FGD SYSTEM HAS NOT YET BEEN DETERMINED.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	ABSTRACT
MIDDLE SOUTH UTILITIES MISSISSIPPI COAL 1 NEW 890.0 MW (GROSS) 890.0 MW (ESC) COAL .50 %S PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 5 STARTUP 0/85	A CONTRACT HAS BEEN AWARDED FOR BOILERS AND TURBINES ON SIX NEW MIDDLE SOUTH UTILITIES UNITS. THE UTILITY IS CURRENTLY REQUESTING/EVALUATING BIDS FOR THE FGD INSTALLATIONS ALTHOUGH THE TYPE OF FGD SYSTEM HAS NOT YET BEEN DETERMINED.
MIDDLE SOUTH UTILITIES MISSISSIPPI COAL 2 NEW 890.0 MW (GROSS) 890.0 MW (ESC) COAL .50 %S PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 5 STARTUP 0/87	A CONTRACT HAS BEEN AWARDED FOR BOILERS AND TURBINES ON SIX NEW MIDDLE SOUTH UTILITIES UNITS. THE UTILITY IS CURRENTLY REQUESTING/EVALUATING BIDS FOR THE FGD INSTALLATIONS ALTHOUGH THE TYPE OF FGD SYSTEM HAS NOT YET BEEN DETERMINED.
MINNESOTA POWER & LIGHT CLAY BOSWELL 4 NEW 500.0 MW (GROSS) 475.0 MW (ESC) COAL .80 %S SUBBITUMINOUS LIME/ALKALINE FLYASH PEABODY PROCESS SYSTEMS ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 5/80	MINNESOTA P&L HAS AWARDED A CONTRACT TO PEABODY PROCESS SYSTEMS FOR A LIME/ALKALINE FLYASH SCRUBBING SYSTEM. THE CONFIGURATION WILL BE VENTURI SCRUBBERS FOLLOWED BY SPRAY TOWERS. HOT SIDE ESP'S WILL BE USED FOR PARTICULATE CONTROL. STACK GAS REHEAT WILL BE ACCOMPLISHED BY BYPASSING 5% OF FLUE GAS AROUND THE SCRUBBER. THE UNIT WILL FIRE SUBBITUMINOUS COLSTRIP COAL WITH A SULFUR CONTENT OF 0.8%, AND AN ASH CONTENT OF 9.0% (HEATING VALUE-8300 BTU/LB). MAKE-UP WATER SOURCE WILL BE THE RIVER AND THE CLAY LINED POND. CONSTRUCTION OF THE FGD SYSTEM IS ABOUT 90% COMPLETE.
MINNKOTA POWER COOPERATIVE MILTON R. YOUNG 2 NEW 477.0 MW (GROSS) 405.0 MW (ESC) COAL .70 %S LIGNITE LIME/ALKALINE FLYASH ADL/COMBUSTION EQUIP ASSOCIATE ENERGY CONSUMPTION: 1.9% STATUS 1 STARTUP 9/77	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THIS LIME/ALKALINE FLYASH SCRUBBING WAS DESIGNED AND SUPPLIED BY ADL/COMBUSTION EQUIPMENT ASSOCIATES. IT CONSISTS OF A COLD-SIDE ESP FOLLOWED BY TWO SPRAY TOWERS. THE DESIGN INCLUDES A WASH TRAY AND A CHEVRON MIST ELIMINATOR. 15% FLUE GAS BYPASS PROVIDES STACK GAS REHEAT. THE UNIT FIRES A LOW-SULFUR NORTH DOKOTA LIGNITE WITH AN AVERAGE ASH CONTENT OF 8 PERCENT, SULFUR CONTENT OF 0.7 PERCENT, AND HEAT CONTENT OF 6500 BTU/LB. THE FLYASH ALKALINITY IS USED AS THE PRIMARY SO2 REAGENT.
MONTANA POWER COLSTRIP 1 NEW 360.0 MW (GROSS) 360.0 MW (ESC) COAL .77 %S SUBBITUMINOUS LIME ADL/COMBUSTION EQUIP ASSOCIATE ENERGY CONSUMPTION: 3.3% STATUS 1 STARTUP 9/75	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THIS FGD EQUIPPED UNIT WAS DECLARED COMMERCIAL IN NOVEMBER 1975. THE SCRUBBING SYSTEM PROVIDES PARTICULATE AND SO2 CONTROL WITH THREE SCRUBBER MODULES. EACH MODULE CONSISTS OF A DOWNFLOW VENTURI SCRUBBER CENTERED WITHIN AN UPFLOW SPRAY TOWER ABSORBER. EACH MODULE CAN TREAT 40% OF THE TOTAL BOILER FLUE GAS AND THE MODULES CANNOT BE BYPASSED. THE UNSTABILIZED SLUDGE IS DISPOSED IN AN ON-SITE LINED DISPOSAL POND. IN-LINE STEAM REHEAT AND CLOSED WATER LOOP CAPABILITY ARE INCLUDED IN THE SYSTEM.
MONTANA POWER COLSTRIP 2 NEW 360.0 MW (GROSS) 360.0 MW (ESC) COAL .77 %S SUBBITUMINOUS LIME ADL/COMBUSTION EQUIP ASSOCIATE ENERGY CONSUMPTION: 3.3% STATUS 1 STARTUP 5/76	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THIS FGD EQUIPPED UNIT WAS DECLARED COMMERCIAL IN AUGUST 1976. THE SCRUBBING SYSTEM PROVIDES PARTICULATE AND SO2 CONTROL WITH THREE SCRUBBER MODULES. EACH MODULE CONSISTS OF A DOWNFLOW VENTURI SCRUBBER CENTERED WITHIN AN UPFLOW SPRAY TOWER ABSORBER. EACH MODULE CAN TREAT 40% OF THE TOTAL BOILER FLUE GAS AND THE MODULES CANNOT BE BYPASSED. THE UNSTABILIZED SLUDGE IS DISPOSED IN AN ON-SITE LINED DISPOSAL POND. IN-LINE STEAM REHEAT AND CLOSED WATER LOOP CAPABILITY ARE INCLUDED IN THE SYSTEM.

UNIT IDENTIFICATION	ABSTRACT
MONTANA POWER COLSTRIP 3 NEW 700.0 MW (GROSS) 700.0 MW (ESC) COAL .70 %S LIME/ALKALINE FLYASH ADL/COMBUSTION EQUIP ASSOCIATE ENERGY CONSUMPTION: ****% STATUS 3 STARTUP 7/80	A CONTRACT FOR THE INSTALLATION OF TWO ADDITIONAL LIME/ALKALINE FLYASH SCRUBBING SYSTEMS HAS BEEN AWARDED TO A.D. LITTLE/COMBUSTION EQUIPMENT ASSOCIATES. THESE SYSTEMS WILL BE INSTALLED ON UNITS 3 AND 4 OF THE COLSTRIP POWER STATION. COLSTRIP UNITS 1 AND 2 ARE BOTH EQUIPPED WITH OPERATIONAL LIME/ALKALINE FLYASH SCRUBBING SYSTEMS FOR THE REMOVAL OF PARTICULATES AND SULFUR DIOXIDE.
MONTANA POWER COLSTRIP 4 NEW 700.0 MW (GROSS) 700.0 MW (ESC) COAL .70 %S LIME/ALKALINE FLYASH ADL/COMBUSTION EQUIP ASSOCIATE ENERGY CONSUMPTION: ****% STATUS 3 STARTUP 7/81	A CONTRACT FOR THE INSTALLATION OF TWO ADDITIONAL LIME/ALKALINE FLYASH SCRUBBING SYSTEMS HAS BEEN AWARDED TO A.D. LITTLE/COMBUSTION EQUIPMENT ASSOCIATES. THESE SYSTEMS WILL BE INSTALLED ON UNITS 3 AND 4 OF THE COLSTRIP POWER STATION. COLSTRIP UNITS 1 AND 2 ARE BOTH EQUIPPED WITH OPERATIONAL LIME/ALKALINE FLYASH SCRUBBING SYSTEMS FOR THE REMOVAL OF PARTICULATES AND SULFUR DIOXIDE.
NEVADA POWER HARRY ALLEN 1 NEW 500.0 MW (GROSS) 500.0 MW (ESC) COAL ***** %S PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 6/85	CONSIDERING HOT SIDE ESP IN CONJUNCTION WITH AN FGD SYSTEM. SPECIFICATIONS HAVE NOT YET BEEN PREPARED.
NEVADA POWER HARRY ALLEN 2 NEW 500.0 MW (GROSS) 500.0 MW (ESC) COAL ***** %S PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 6/86	CONSIDERING HOT SIDE ESP IN CONJUNCTION WITH AN FGD SYSTEM. SPECIFICATIONS HAVE NOT YET BEEN PREPARED.
NEVADA POWER HARRY ALLEN 3 NEW 500.0 MW (GROSS) 500.0 MW (ESC) COAL ***** %S PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 6/87	CONSIDERING HOT SIDE ESP IN CONJUNCTION WITH AN FGD SYSTEM. SPECIFICATIONS HAVE NOT YET BEEN PREPARED.
NEVADA POWER HARRY ALLEN 4 NEW 500.0 MW (GROSS) 500.0 MW (ESC) COAL ***** %S PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 6/88	CONSIDERING HOT SIDE ESP IN CONJUNCTION WITH AN FGD SYSTEM. SPECIFICATIONS HAVE NOT YET BEEN PREPARED.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	ABSTRACT
NEVADA POWER REID GARDNER 1 RETROFIT 125.0 MW (GROSS) 125.0 MW (ESC) COAL .50 %S SODIUM CARBONATE ADL/COMBUSTION EQUIP ASSOCIATE ENERGY CONSUMPTION: ****% STATUS 1 STARTUP 4/74	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THIS SODIUM CARBONATE-BASED (TRONA) SCRUBBING SYSTEM CONSISTS OF ONE MODULE CONTAINING A TWIN VARIABLE THROAT VENTURI SCRUBBER FOLLOWED BY A SEPARATOR IN SERIES WITH A SINGLE-STAGE PERFORATED-PLATE WASH TOWER. PRIMARY PARTICULATE CONTROL IS PROVIDED BY UPSTREAM MECHANICAL COLLECTORS. AN INDIRECT STEAM HOT AIR REHEAT SYSTEM RAISES THE GAS TEMPERATURE 30F PRIOR TO DISCHARGE TO THE MAIN STACK. THE FLUE GAS CLEANING WASTES ARE ULTIMATELY DISPOSED IN AN ON-SITE CLAY-LINED SOLAR EVAPORATION POND.
NEVADA POWER REID GARDNER 2 RETROFIT 125.0 MW (GROSS) 125.0 MW (ESC) COAL .50 %S SODIUM CARBONATE ADL/COMBUSTION EQUIP ASSOCIATE ENERGY CONSUMPTION: ****% STATUS 1 STARTUP 4/74	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THIS SODIUM CARBONATE-BASED (TRONA) SCRUBBING SYSTEM CONSISTS OF ONE MODULE CONTAINING A TWIN VARIABLE THROAT VENTURI SCRUBBER FOLLOWED BY A SEPARATOR IN SERIES WITH A SINGLE-STAGE PERFORATED-PLATE WASH TOWER. PRIMARY PARTICULATE CONTROL IS PROVIDED BY UPSTREAM MECHANICAL COLLECTORS. AN INDIRECT STEAM HOT AIR REHEAT SYSTEM RAISES THE GAS TEMPERATURE 30F PRIOR TO DISCHARGE TO THE MAIN STACK. THE FLUE GAS CLEANING WASTES ARE ULTIMATELY DISPOSED IN AN ON-SITE CLAY-LINED SOLAR EVAPORATION POND.
NEVADA POWER REID GARDNER 3 NEW 125.0 MW (GROSS) 125.0 MW (ESC) COAL .50 %S SODIUM CARBONATE ADL/COMBUSTION EQUIP ASSOCIATE ENERGY CONSUMPTION: ****% STATUS 1 STARTUP 6/76	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THIS UNIT IS A NEW COAL-FIRED BOILER THAT IS EQUIPPED WITH SODIUM CARBONATE-BASED (TRONA) SCRUBBING SYSTEM WHICH INCORPORATES A TWIN VARIABLE-THROAT VENTURI SCRUBBER FOLLOWED BY A SEPARATOR IN SERIES WITH A SINGLE-STAGE PERFORATED-PLATE WASH TOWER. MECHANICAL COLLECTORS PROVIDE PRIMARY PARTICULATE CONTOL. REHEAT IS PROVIDED BY A INDIRECT STEAM HOT AIR REHEAT SYSTEM. WASTE IS DISPOSED IN AN ON-SITE CLAY-LINED POND.
NEVADA POWER REID GARDNER 4 NEW 250.0 MW (GROSS) 250.0 MW (ESC) COAL .75 %S PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 0/83	NEVADA POWER COMPANY HAS SCRAPPED THEIR ORIGINAL PLANS TO MAKE UNIT 4 A COPY OF UNIT 3. THE NEW PLANS CALL FOR A 250-MW UNIT TO BE IN OPERATION BY 1983. THE UTILITY IS PREPARING SPECIFICATIONS AT THIS TIME. CONSTRUCTION IS SCHEDULED TO START IN 1980.
NEVADA POWER WARNER VALLEY 1 NEW 250.0 MW (GROSS) 250.0 MW (ESC) COAL ***** %S PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 6/84	SPECIFICATIONS ARE BEING PREPARED FOR A SCRUBBING SYSTEM. NEVADA POWER HAS NOT YET ANNOUNCED PLANS FOR THIS UNIT'S EMISSION CONTROL STRATEGY.
NEVADA POWER WARNER VALLEY 2 NEW 250.0 MW (GROSS) 250.0 MW (ESC) COAL ***** %S PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 6/85	SPECIFICATIONS ARE BEING PREPARED FOR A SCRUBBING SYSTEM. NEVADA POWER HAS NOT YET ANNOUNCED PLANS FOR THIS UNIT'S EMISSION CONTROL STRATEGY.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	ABSTRACT
NEW ENGLAND ELECTRIC SYSTEM BRAYTON POINT 3 RETROFIT 650.0 MW (GROSS) 650.0 MW (ESC) OIL 1.00 %S LOW SULFUR PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 7 STARTUP 0/ 0	NEW ENGLAND ELECTRIC SYSTEM HAS REQUESTED PERMISSION TO BURN 1.5% SULFUR COAL AT THIS UNIT. THIS IS ALLOWABLE UNDER STATE STANDARDS BUT SO2 EMISSIONS WOULD BE ABOVE ALLOWABLE FEDERAL LEVELS. A DECISION BY THE EPA IS STILL PENDING. MEANWHILE, THE UTILITY IS INVESTIGATING VARIOUS ADVANCE REGENERABLE FGD SYSTEMS WHICH OFFER A BREAKTHROUGH IN OPERATING COSTS AND PRODUCE ELEMENTAL SULFUR AS AN END PRODUCT. THE UTILITY IS CURRENTLY INVOLVED IN BENCH AND LABORATORY SCALE INVESTIGATIONS OF SULFUR RECOVERY. THIS UNIT IS CURRENTLY OPERATIONAL FIRING LOW SULFUR FUEL OIL.
NIAGARA MOHAWK POWER COOP CHARLES R. HUNTLEY 66 RETROFIT 100.0 MW (GROSS) 100.0 MW (ESC) COAL 1.80 %S AQUEOUS CARBONATE ROCKWELL INTERNATIONAL ENERGY CONSUMPTION: ****% STATUS 3 STARTUP 0/82	A CONTRACT WAS AWARDED TO ATOMICS INTERNATIONAL FOR THE DESIGN AND INSTALLATION OF AN AQUEOUS CARBONATE FGD SYSTEM. THIS DEMONSTRATION SYSTEM WILL PRODUCE END-PRODUCT SULFUR. FUNDS ARE BEING PROVIDED BY THE U.S. EPA AND THE EMPIRE STATE ELECTRIC ENERGY RESEARCH CORP. THE DESIGN SO2 REMOVAL EFFICIENCY WILL BE 90 PERCENT. ROCKWELL INTERNATIONAL IS PRESENTLY IN THE DESIGN PHASE.
NORTHERN INDIANA PUB SERVICE BAILLY 7 RETROFIT 190.0 MW (GROSS) 190.0 MW (ESC) COAL 3.00 %S PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 0/ 0	NORTHERN INDIANA PUBLIC SERVICE IS CURRENTLY CONSIDERING A LIME OR LIMESTONE SCRUBBING UNIT FOR BAILLY 7 AND 8. THEY ARE ALSO WAITING FOR PERFORMANCE RESULTS OF THE WELLMAN LORD/ALLIED CHEMICAL UNIT IN SERVICE AT DEAN H. MITCHELL 11. LOW SULFUR COAL MAY BE EMPLOYED TO COMPLY WITH SO2 EMISSION REGUALTIONS. APPLICABLE INDIANA SO2 REGULATIONS ARE STILL NOT FIRMLY ESTABLISHED.
NORTHERN INDIANA PUB SERVICE BAILLY 8 RETROFIT 400.0 MW (GROSS) 400.0 MW (ESC) COAL 3.00 %S PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 0/ 0	NORTHERN INDIANA PUBLIC SERVICE IS CURRENTLY CONSIDERING A LIME OR LIMESTONE SCRUBBING UNIT FOR BAILLY 7 AND 8. THEY ARE ALSO WAITING FOR PERFORMANCE RESULTS OF THE WELLMAN LORD/ALLIED CHEMICAL UNIT IN SERVICE AT DEAN H. MITCHELL 11. LOW SULFUR COAL MAY BE EMPLOYED TO COMPLY WITH SO2 EMISSION REGULATIONS. APPLICABLE INDIANA SO2 REGULATIONS ARE STILL NOT FIRMLY ESTABLISHED.
NORTHERN INDIANA PUB SERVICE DEAN H. MITCHELL 11 RETROFIT 115.0 MW (GROSS) 115.0 MW (ESC) COAL 3.50 %S WELLMAN LORD DAVY POWERGAS ENERGY CONSUMPTION: ****% STATUS 1 STARTUP 7/76	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION THIS FGD SYSTEM IS AN INTEGRATION OF THE WELLMAN-LORD SO2 RECOVERY PROCESS OFFERED BY DAVY POWERGAS AND THE SO2 TO SULFUR REDUCTION PROCESS DEVELOPED BY ALLIED CHEMICAL. DAVY POWERGAS IS THE DESIGN AND CONSTRUCTION FIRM AND ALLIED CHEMICAL IS SYSTEM OPERATOR AND PRODUCT MARKETER. PERFORMANCE TESTS WERE SUCCESSFULLY COMPLETED ON SEPTEMBER 14, 1977. A DEMONSTRATION YEAR COMMENCED ON SEPTEMBER 16, 1977.
NORTHERN STATES POWER SHERBURNE 1 NEW 720.0 MW (GROSS) 720.0 MW (ESC) COAL .80 %S SUBBITUMINOUS LIMESTONE/ALKALINE FLYASH COMBUSTION ENGINEERING ENERGY CONSUMPTION: 2.8% STATUS 1 STARTUP 3/76	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. FULL COMMERCIAL OPERATION OF THE SYSTEM BEGAN ON MAY 1, 1976. THE SCRUBBING SYSTEM FOR THIS UNIT CONSISTS OF 12 MODULES. EACH SCRUBBING MODULE INCORPORATES A VENTRI-ROD SECTION AND A MARBLE BED ABSORBER FOR PARTICULATE AND SULFUR DIOXIDE REMOVAL. A FORCED OXIDATION SYSTEM CONVERTS ALL THE CALCIUM SULFITE TO SULFATE PRIOR TO DISCHARGE TO A CLAY-LINED SETTLING POND. STACK GAS REHEAT IS PROVIDED BY IN-LINE HOT WATER TUBES. THE COAL BURNED AT THIS UNIT CONTAINS 0.8% SULFUR AND 9-10% ASH.

UNIT IDENTIFICATION	ABSTRACT
NORTHERN STATES POWER SHERBURNE 2 NEW 720.0 MW (GROSS) 720.0 MW (ESC) COAL .80 %S SUBBITUMINOUS LIMESTONE/ALKALINE FLYASH COMBUSTION ENGINEERING ENERGY CONSUMPTION: 2.8% STATUS 1 STARTUP 4/77	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE SHERBURNE NO. 2 AIR QUALITY CONTROL SYSTEM IS IDENTICAL IN DESIGN TO THE SYSTEM IN OPERATION ON THE NO. 1 UNIT AT THIS STATION. TWELVE 2-STAGE PARTICULATE SCRUBBER (VENTRI-ROD SCRUBBER) AND SULFUR DIOXIDE ABSORBER (MARBLE-BED ABSORBER) MODULES ARE PROVIDED FOR FLYASH AND SO2 CONTROL. ELEVEN MODULES ARE EQUIPPED FOR FULL GENERATING CAPACITY OPERATIONS. THE CALCIUM SULFITE IS FORCIBLY OXIDIZED TO SULFATE PRIOR TO DISCHARGE TO THE DISPOSAL POND. IN-LINE HOT WATER TUBES PROVIDE STACK GAS REHEAT.
NORTHERN STATES POWER SHERBURNE 3 NEW 860.0 MW (GROSS) 720.0 MW (ESC) COAL .80 %S LIMESTONE COMBUSTION ENGINEERING ENERGY CONSUMPTION: ****% STATUS 4 STARTUP 5/84	TWO ADDITIONAL COAL-FIRED POWER-GENERATING UNITS ARE SCHEDULED TO BE INSTALLED AT NSP'S SHERBURNE COUNTY GENERATING STATION IN BECKER MINNESOTA. A LETTER OF INTENT HAS BEEN SIGNED WITH C-E FOR A LIMESTONE SLURRY SPRAY TOWER SYSTEM FOR THIS NEW 860-MW UNIT. THE 2-STAGE SCRUBBING SYSTEM WILL REMOVE PARTICULATES (99.5%) & SO2 (80%). THE BOILER CONTRACT HAS BEEN AWARDED TO BABCOCK & WILCOX AND THE TURBINE WILL BE SUPPLIED BY GENERAL ELECTRIC. START-UP HAS BEEN DELAYED TO MAY 1984 AND CONSTRUCTION START-UP HAS BEEN DELAYED UNTIL APRIL 1980 DUE TO ENVIRONMENTAL PROBLEMS.
OTTER TAIL POWER COYOTE 1 NEW 440.0 MW (GROSS) 440.0 MW (ESC) COAL .87 %S LIGNITE AQUEOUS CARBONATE (DRY COLLECT WHEELABRATOR-FRYE/R.I. ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 5/81	THIS NEW COAL-FIRED STATION IS JOINTLY OWNED BY FIVE UTILITIES. OTTER TAIL POWER IS THE MAJOR OWNER AND CONSTRUCTOR. MONTANA-DAKOTA UTILITES IS THE FACILITY OPERATOR. THIS PLANNED UNIT WILL FIRE LOW SULFUR LIGNITE FROM THE MERCER COUNTY AREA IN A B&W CYCLONE BOILER. THE CONTRACT FOR THIS AQUEOUS CARBONATE/FABRIC FILTER SO2 SCRUBBER-ABSORBER WAS AWARDED TO WHEELABRATOR-FRYE AND ATOMICS INTERNATIONAL. THE DRY REMOVAL SYSTEM COMBINES AI'S AQUEOUS CARBONATE PROCESS IN A W-F FABRIC FILTER. UNIT CONSTRUCTION IS NOW 30% COMPLETE AND FGD SYSTEM CONSTRUCTION HAS JUST BEGUN.
PACIFIC GAS & ELECTRIC FOSSIL 1 NEW 800.0 MW (GROSS) 800.0 MW (ESC) COAL .80 %S LIMESTONE VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 0/85	PG&E ANNOUNCED PLANS TO BUILD TWO 800-MW COAL-FIRED POWER GENERATING UNITS IN NORTHERN CALIFORNIA. THE FIRST UNIT WILL BURN COAL WITH A HEATING VALUE OF 12000 BTU/LB, 0.8% SULFUR AND 10% ASH CONTENTS. THE SECOND UNIT WILL BURN COAL OF AN EQUAL OR BETTER QUALITY. THE EMISSION CONTROL SYSTEM WILL CONSIST OF A BAGHOUSE AND A LIMESTONE FGD SYSTEM. SLUDGE WILL BE DISPOSED OF IN A LANDFILL. START-UP DATES ARE 1985 AND 1986 FOR NOS. 1 AND 2 RESPECTIVELY. CONSTRUCTION IS NOT ENVISIONED TO BEGIN BEFORE TWO OR THREE YEARS.
PACIFIC GAS & ELECTRIC FOSSIL 2 NEW 800.0 MW (GROSS) 800.0 MW (ESC) COAL .80 %S LIMESTONE VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 0/86	PG&E ANNOUNCED PLANS TO BUILD TWO 800-MW COAL-FIRED POWER GENERATING UNITS IN NORTHERN CALIFORNIA. THE FIRST UNIT WILL BURN COAL WITH A HEATING VALUE OF 12000 BTU/LB, 0.8% SULFUR AND 10% ASH CONTENTS. THE SECOND UNIT WILL BURN COAL OF AN EQUAL OR BETTER QUALITY. THE EMISSION CONTROL SYSTEM WILL CONSIST OF A BAGHOUSE AND A LIMESTONE FGD SYSTEM. SLUDGE WILL BE DISPOSED OF IN A LANDFILL. START-UP DATES ARE 1985 AND 1986 FOR NOS. 1 AND 2 RESPECTIVELY. CONSTRUCTION IS NOT ENVISIONED TO BEGIN BEFORE TWO OR THREE YEARS.
PACIFIC POWER & LIGHT JIM BRIDGER 4 NEW 550.0 MW (GROSS) 550.0 MW (ESC) COAL .56 %S SUBBITUMINOUS SODIUM CARBONATE AIR CORRECTION DIVISION, UOP ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 9/79	THE AIR CORRECTION DIVISION OF UOP WAS AWARDED A CONTRACT FOR AN FGD SYSTEM AT THIS NEW-500 MW COAL-FIRED UNIT. THE FGD SYSTEM WILL CONSIST OF PARALLEL TRAY TOWER ABSORBER MODULES, EACH TREATING ONE-THIRD OF THE BOILER FLUE GAS AT FULL LOAD. AN ESP WILL PROVIDE PRIMARY PARTICULATE CONTROL. AN ACID BRICK LINED WET STACK IS INCLUDED IN THE SYSTEM. PPL'S PILOT STUDY INSPECTION REVEALED SCALE FORMATION PROBLEMS. TESTS ARE BEING CONDUCTED TO RESOLVE THIS PROBLEM. THE UTILITY EXPECTS TO CONDUCT A SYSTEM CHECKOUT IN 7/79 WITH COMMERCIAL STARTUP AT THE END OF 1979.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	ABSTRACT
PENNSYLVANIA POWER BRUCE MANSFIELD 1 NEW 917.0 MW (GROSS) 917.0 MW (ESC) COAL 3.00 %S BITUMINOUS LIME CHEMICO ENERGY CONSUMPTION: 6.0% STATUS 1 STARTUP 12/75	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THIS EMISSION CONTROL SYSTEM WAS DESIGNED TO REMOVE FLYASH AND SO2 FROM 3.35 MM ACFM OF FLUEGAS USING THIOSORBIC LIME AS A SCRUBBING ABSORBENT. THE INITIAL SHAKEDOWN AND DEBUGGING PHASE OF OPERATION BEGAN FOR PART OF THE SYSTEM IN DECEMBER 1975. PARTIAL COMMERCIAL OPERATION COMMENCED IN APRIL 1976. THE UNIT WAS CERTIFIED FULL-LOAD COMMERCIAL IN JUNE 1976. THE FGD SYSTEM HAS EXPERIENCED OPERATIONAL PROBLEMS SINCE IT HAS BEEN IN SERVICE REQUIRING A NUMBER OF SYSTEM REPAIRS AND DESIGN MODIFICATIONS.
PENNSYLVANIA POWER BRUCE MANSFIELD 2 NEW 917.0 MW (GROSS) 917.0 MW (ESC) COAL 3.00 %S BITUMINOUS LIME CHEMICO ENERGY CONSUMPTION: 6.0% STATUS 1 STARTUP 7/77	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THIS EMISSION CONTROL SYSTEM WAS DESIGNED TO REMOVE FLYASH AND SO2 FROM 3.35 MM ACFM OF FLUE GAS USING THIOSORBIC LIME AS A SCRUBBING ABSORBENT. SIX SCRUBBING TRAINS, EACH INCLUDING TWO VENTURI SCRUBBERS IN SERIES ARRANGEMENT, ARE PROVIDED FOR FULL-LOAD OPERATION. THE INITIAL SHAKEDOWN AND DEBUGGING PHASE OF OPERATION BEGAN FOR THREE TRAINS IN JULY, 1977. FULL COMMERCIAL OPERATION FOR THE ENTIRE SYSTEM COMMENCED ON OCTOBER 1, 1977.
PENNSYLVANIA POWER BRUCE MANSFIELD 3 NEW 917.0 MW (GROSS) 917.0 MW (ESC) COAL 3.00 %S LIME PULLMAN KELLOGG ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 4/80	A CONTRACT WAS AWARDED TO PULLMAN KELLOGG FOR THE FGD SYSTEM AT THIS UNIT. THE EMISSION CONTROL SYSTEM FOR THIS UNIT WILL CONSIST OF ESP'S UP-STREAM OF FIVE WEIR HORIZONTAL CROSSFLOW WET SCRUBBING MODULES. EACH MODULE CONSISTS OF SIX STAGES, ONE BEING A SPARE. SLUDGE WILL BE DISPOSED OF BY THE EXISTING SYSTEM AT THE BRUCE MANSFIELD PLANT. LINER IN THE STACK WILL BE AN INCONEL 625 MATERIAL. THE UNIT IS CURRENTLY UNDER CONSTRUCTION WITH ESP'S 70-80 PERCENT COMPLETE AND THE FGD SYSTEM 30 PERCENT COMPLETE. UNIT START-UP WILL BE IN APRIL 1980.
PHILADELPHIA ELECTRIC CROMBY RETROFIT 150.0 MW (GROSS) 150.0 MW (ESC) COAL 3.00 %S MAGNESIUM OXIDE UNITED ENGINEERS ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 6/80	THE UTILITY PLANS TO RETROFIT ONE OF THE TWO BOILERS AT CROMBY WITH AN FGD SYSTEM. HOWEVER, A FINAL DECISION HAS NOT BEEN MADE. THE SYSTEM BEING GIVEN PRIMARY CONSIDERATION IS MAGNESIUM OXIDE. CURRENTLY, THE UTILITY IS RE-NEGOTIATING CONSENT ORDERS AND THE START-UP DATE OF JUNE 1980 IS TENTATIVE.
PHILADELPHIA ELECTRIC EDDYSTONE 1A RETROFIT 120.0 MW (GROSS) 120.0 MW (ESC) COAL 2.60 %S MAGNESIUM OXIDE UNITED ENGINEERS ENERGY CONSUMPTION: ****% STATUS 1 STARTUP 9/75	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE EMMISSION CONTROL SYSTEM FOR THIS UNIT CONSISTS OF THREE PARALLEL SCRUBBING TRAINS FOR THE CONTROL OF PARTICULATE AND SULFUR DIOXIDE. THE C-SIDE SCRUBBING TRAIN INCLUDES AN SO2 ABSORBER MODULE IN SERIES WITH A PARTICULATE SCRUBBER. APPROXIMATELY ONE-THIRD OF THE BOILER FLUE GAS IS SCRUBBED WITH MAGNESIUM OXIDE SLURRY FOR SO2 REMOVAL. THE SPENT SLURRY IS REGENERATED AT THE ESSEX SULFURIC ACID PLANT IN NEWARK, N.J. THE REGENERATED MAGOX IS RETURNED TO THE PLANT FOR SO2 SCRUBBING SERVICE.
PHILADELPHIA ELECTRIC EDDYSTONE 1B RETROFIT 240.0 MW (GROSS) 240.0 MW (ESC) COAL 2.60 %S MAGNESIUM OXIDE UNITED ENGINEERS ENERGY CONSUMPTION: ****% STATUS 4 STARTUP 6/80	THE INSTALLATION OF AN FGD SYSTEM ON THE BALANCE OF THE FLUE GAS FROM THIS UNIT WILL FOLLOW PENDING THE OUTCOME OF THE PERFORMANCE OF THE EXPERIMENTAL SCRUBBING UNIT WHICH HAS BEEN INSTALLED AND CURRENTLY OPERATIONAL ON THIS UNIT. CURRENTLY, 3 PARTICULATE SCRUBBERS ARE TREATING THE FULL GAS LOAD FROM THIS UNIT. CONSENT ORDERS ARE PRESENTLY BEING RE-NEGOTIATED AND THE START-UP DATE OF JUNE, 1980 IS TENTATIVE.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	ABSTRACT
PHILADELPHIA ELECTRIC EDDYSTONE 2 RETROFIT 334.0 MW (GROSS) 334.0 MW (ESC) COAL 2.50 %S MAGNESIUM OXIDE UNITED ENGINEERS ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 6/80	THE UTILITY IS AWAITING PERFORMANCE RESULTS FROM THE EXPERIMENTAL FGD SYSTEM INSTALLED ON UNIT 1 AT THIS STATION BEFORE PRECEEDING WITH THE DESIGN OF AN FGD SYSTEM FOR THIS COAL-FIRED BOILER. THE SYSTEM BEING GIVEN PRIMARY CONSIDERATION IS MAGNESIUM OXIDE, DESIGNED JOINTLY BY UNITED ENGINEERS AND PHILADELPHIA ELECTRIC. CURRENTLY, THE UTILITY IS RE-NEGOTIATING CONSENT ORDERS AND THE START UP DATE OF JUNE 1980 IS TENTATIVE.
POTOMAC ELECTRIC POWER DICKERSON 4 NEW 800.0 MW (GROSS) 800.0 MW (ESC) COAL 2.00 %S PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 5/85	THERE ARE NO FIRM PLANS FOR INSTALLATION OF AN FGD SYSTEM. STARTUP DATE OF THE BOILER IS PLANNED FOR 1985. THIS UNIT WILL BURN 2% SULFUR COAL WITH A HEATING VALUE OF 11000 BTU/LB.
POWER AUTHORITY OF NEW YORK ARTHUR KILL NEW 700.0 MW (GROSS) 700.0 MW (ESC) COAL 3.00 %S PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 11/88	THE UTILITY IS CONSIDERING BOTH REGENERABLE AND LIMESTONE FGD PROCESSES. FGD TECHNOLOGY IS BEING CONSIDERED FOR A FOSSIL FUEL BURNING UNIT WHICH WILL EMPLOY COAL AS THE PRIMARY FUEL AND OIL AS BACKUP. REFUSE WILL BE PROVIDED AS A SUPPLEMENTAL FUEL SUPPLY. THE PREFERRED PLANT SITE IS THE ARTHUR KILL FACILITY LOCATED ON STATEN ISLAND. THE PROJECT DESIGN ENGINEERING FIRM IS SARGENT AND LUNDY. PUBLIC SERVICE COMMISSION HEARINGS ARE IN PROGRESS.
PUBLIC SERVICE OF INDIANA GIBSON 5 NEW 650.0 MW (GROSS) 650.0 MW (ESC) COAL 3.30 %S PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 5 STARTUP 0/82	PUBLIC SERVICE CO OF INDIANA ANNOUNCED PLANS FOR THE CONSTRUCTION OF THIS NEW 650-MW COAL FIRED POWER GENERATING UNIT AT GIBSON STATION. BIDS HAVE BEEN RECIEVED AND ARE BEING EVALUATED. INITIAL START-UP IS SCHEDULED FOR 1982.
PUBLIC SERVICE OF NEW MEXICO SAN JUAN 1 RETROFIT 361.0 MW (GROSS) 361.0 MW (ESC) COAL .80 %S WELLMAN LORD DAVY POWERGAS ENERGY CONSUMPTION: ****% STATUS 1 STARTUP 4/78	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THIS FGD SYSTEM IS AN INTEGRATION OF THE WELLMAN LORD SO2 RECOVERY PROCESS OF DAVY POWERGAS AND ALLIED CHEMICAL'S SO2 REDUCTION TO SULFUR PROCESS. A HOT SIDE ELECTROSTATIC PRECIPITATOR PRECEEDS THE FGD SYSTEM. OF THE FOUR ABSORBER TOWERS INSTALLED, THREE ARE NEEDED TO CARY THE FULL LOAD. THE COAL BURNED AT THIS UNIT HAS SULFUR AND ASH CONTENTS OF .8% AND 20% RESPECTIVELY. THE SYSTEM OPERATES ON A CLOSED WATER LOOP WITH RIVER WATER BEING USED AS MAKE-UP FOR LOSSES DUE TO EVAPORATION.
PUBLIC SERVICE OF NEW MEXICO SAN JUAN 2 RETROFIT 350.0 MW (GROSS) 350.0 MW (ESC) COAL .80 %S WELLMAN LORD DAVY POWERGAS ENERGY CONSUMPTION: ****% STATUS 1 STARTUP 8/78	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THIS FGD SYSTEM IS AN INTEGRATION OF THE WELLMAN LORD SO2 RECOVERY PROCESS OF DAVY POWERGAS/ALLIED CHEMICAL'S SO2 REDUCTION TO SULFUR PROCESS. A HOT SIDE ELECTROSTATIC PRECIPITATOR PRECEEDS THE FGD SYSTEM. THE SYSTEM INCLUDES FOUR ABSORBER TOWERS, THREE OF WHICH ARE NECESSARY TO CARRY THE FULL LOAD. THE WATER LOOP IS CLOSED WITH RIVER WATER BEING USED TO MAKE UP FOR LOSSES DUE TO EVAPORATION. THE COAL BURNED AT THIS UNIT HAS SULFUR AND ASH CONTENTS OF 0.8% AND 20% RESPECTIVELY.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	ABSTRACT
PUBLIC SERVICE OF NEW MEXICO SAN JUAN 3 NEW 534.0 MW (GROSS) 534.0 MW (ESC) COAL .80 %S WELLMAN LORD DAVY POWERGAS ENERGY CONSUMPTION: ****% STATUS 3 STARTUP 6/79	A CONTRACT HAS BEEN AWARDED TO DAVY POWERGAS TO SUPPLY FOUR ABSORBER TOWERS FOR REMOVAL OF SO2 AT THIS NEW UNIT. ONE MODULE IS EXPECTED TO BE OPERATIONAL BY JUNE 1979 WHICH WILL BRING THE UNIT INTO COMPLIANCE WITH FEDERAL NSPS. THE REMAINING THREE MODULES SHOULD BE OPERATIONAL BY JANUARY 1982 AT WHICH TIME THE UNIT WILL BE IN COMPLIANCE OF STATE STANDARDS. POWER PLANT CONSTRUCTION IS BEHIND SCHEDULE BUT ABSORBER CONSTRUCTION IS PROCEEDING AS PLANNED. IT IS POSSIBLE THAT THE FINAL THREE ABSORBERS MAY BE IN AS EARLY AS JANUARY 1981.
PUBLIC SERVICE OF NEW MEXICO SAN JUAN 4 NEW 534.0 MW (GROSS) 534.0 MW (ESC) COAL .80 %S WELLMAN LORD DAVY POWERGAS ENERGY CONSUMPTION: ****% STATUS 3 STARTUP 1/82	DAVY POWERGAS HAS BEEN AWARDED A CONTRACT TO SUPPLY THE SO2 REMOVAL SYSTEM FOR THIS UNIT. THE PLANS INCLUDE A WELLMAN LORD SO2 RECOVERY PROCESS AS WELL AS AN UPSTREAM ELECTROSTATIC PRECIPITATOR FOR PRIMARY PARTICULATE REMOVAL. FGD OPERATIONS ARE EXPECTED TO BEGIN AT THIS PLANT IN JANUARY 1982.
SALT RIVER PROJECT CORONADO 1 NEW 350.0 MW (GROSS) 280.0 MW (ESC) COAL 1.00 %S SUBBITUMINOUS LIMESTONE PULLMAN KELLOGG ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 8/79	THIS NEW UNIT WILL BURN LOW SULFUR WESTERN COAL. A MAXIMUM OF 80% OF THE FLUE GAS WILL BE SCRUBBED TO MEET SULFUR DIOXIDE EMISSION REGULATIONS. PULLMAN/KELLOGG WILL PROVIDE 2 WEIR HORIZONTAL SPRAY TOWERS UTILIZING LIMESTONE SLURRY FOR SO2 CONTROL. THE SYSTEM WILL UTILIZE RUBBER-LINED SLURRY RECYCLE PUMPS, EACH RATED AT 9800 GPM. RIGIFLAKE-LINED SCRUBBER MODULES, VERTICAL HEIL MIST ELIMINATORS AND A MINIMUM OF 20 PERCENT OF THE FLUE GAS WILL BE BYPASSED FOR REHEAT. THE SLUDGE WILL BE PONDED. STRUCTURAL WORK IS 90% COMPLETE.
SALT RIVER PROJECT CORONADO 2 NEW 350.0 MW (GROSS) 280.0 MW (ESC) COAL 1.00 %S SUBBITUMINOUS LIMESTONE PULLMAN KELLOGG ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 1/80	THIS NEW UNIT WILL BURN LOW SULFUR WESTERN COAL. A MAXIMUM OF 80% OF THE FLUE GAS WILL BE SCRUBBED TO MEET SULFUR DIOXIDE EMISSION REGULATIONS. PULLMAN/KELLOGG WILL PROVIDE 2 WEIR HORIZONTAL SPRAY TOWERS UTILIZING LIMESTONE SLURRY FOR SO2 CONTROL. THE SYSTEM WILL UTILIZE RUBBER-LINED SLURRY RECYCLE PUMPS, EACH RATED AT 9800 GPM, RIGIFLAKE-LINED SCRUBBER MODULES, VERTICAL HEIL MIST ELIMINATORS AND A MINIMUM OF 20 PERCENT OF THE FLUE GAS WILL BE BYPASSED FOR REHEAT. THE SLUDGE WILL BE PONDED. STRUCTURAL WORK IS 60% COMPLETE.
SALT RIVER PROJECT CORONADO 3 NEW 350.0 MW (GROSS) 280.0 MW (ESC) COAL 1.00 %S LIMESTONE VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 0/87	THIS NEW UNIT WILL BURN SULDOUR WESTERN COAL. EIGHTY PERCENT OF THE GAS WILL BE SCRUBBED TO MEET SULFUR DIOXIDE EMISSION REGULATIONS. UTILITY IS CURRENTLY CONSIDERING THE INSTALLATION OF TWO HORIZONTAL SPRAY TOWERS EMPLOYING A LIMESTONE SCRUBBING SOLUTION TO REMOVE SO2. FROM THE FLUE GAS. SCHEDULED COMMERCIAL OPERATION DATE IS 1987. PLANS FOR AN EMISSION CONTROL SYSTEM HAVE NOT BEEN FINALIZED. SLUDGE WILL PROBABLY BE PONDED.
SAN MIGUEL ELECTRIC COOP SAN MIGUEL 1 NEW 400.0 MW (GROSS) 400.0 MW (ESC) COAL 1.70 %S LIGNITE LIMESTONE BABCOCK & WILCOX ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 8/80	THE EMISSION CONTROL EQUIPMENT FOR THE COAL-FIRED RADIANT BOILER WILL CONSIST OF AN ESP UPSTREAM OF FOUR LIMESTONE SCRUBBING MODULES. THE SCRUBBER FLUE GAS CAPACITY IS NOMINALLY DESIGNED AT 1.579 MILLION ACFM (302 F). DESIGN SO2 REMOVAL EFFICIENCY IS 86 PERCENT FOR 4400 PPM SO2 INLET. L/G RATIOS ARE 10 AND 45 FOR QUENCHER AND ABSORBER, RESPECTIVELY. RESEARCH COTTRELL HAS BEEN AWARDED THE SLUDGE DISPOSAL CONTRACT. FGD SYSTEM FOUNDATION AND STRUCTURAL STEEL WORK IS COMPLETE. INITIAL START-UP IS SCHEDULED FOR LATE SUMMER 1980.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	ABSTRACT
SEMINOLE ELECTRIC SEMINOLE 1 NEW 620.0 MW (GROSS) 620.0 MW (ESC) COAL 2.75 %S LIMESTONE VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 6/83	SEMINOLE ELECTRIC HAS ANNOUNCED PLANS TO CONSTRUCT ONE AND POSSIBLY TWO NEW 600 MW COAL-FIRED UNITS. THE UTILITY INTENDS TO UTILIZE ESPs FOR PARTICULATE REMOVAL AND A LIMESTONE FGD SYSTEM FOR SO2 CONTROL OF EMISSIONS FROM THE BURNING OF 2.75% SULFUR, 8.5% ASH COAL (11000 BTU/LB HEATING VALUE). THE UTILITY EXPECTS TO INITIATE REQUESTS FOR BIDS FOR THE FGD SYSTEM IN MAY 1979.
SIKESTON BOARD OF MUNIC. UTIL. SIKESTON 1 NEW 235.0 MW (GROSS) 235.0 MW (ESC) COAL 2.80 %S LIMESTONE BABCOCK & WILCOX ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 6/81	B&W WAS AWARDED A CONTRACT FOR THE BOILER AIR QUALITY CONTROL SYSTEM. THE AQCS WILL CONSIST OF 2 ESP'S FOLLOWED BY 3 FGD MODULES, EACH CAPABLE OF HANDLING 50% OF THE BOILER LOAD; ONE WILL BE ON STAND-BY AT ALL TIMES. THE UNIT WILL BURN A 2.8% SULFUR COAL. THE SIKESTON STATION WILL FEATURE AN FRP-LINED STACK, 2 PONDS (ONE FOR FLY ASH, ONE FOR SCRUBBER SLUDGE-BOTTOM ASH DISPOSAL), AND 4 AXIAL FLOW FANS. NO STACK GAS REHEAT IS PLANNED. MAXIMUM FLUE GAS CAPACITY IS 748,390 ACFM AT 288 F. BOILER STRUCTURAL STEEL ERECTION IS NOW ABOUT 33% COMPLETE
SOUTH CAROLINA PUBLIC SERVICE WINYAH 2 NEW 280.0 MW (GROSS) 140.0 MW (ESC) COAL 1.00 %S BITUMINOUS LIMESTONE BABCOCK & WILCOX ENERGY CONSUMPTION: .7% STATUS 1 STARTUP 7/77	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE EMISSION CONTROL SYSTEM FOR THIS UNIT CONSISTS OF A 100% CAPACITY ESP FOLLOWED BY A 50% CAPACITY LIMESTONE FGD SYSTEM. ONE FGD MODULE, CONSISTING OF A VENTURI SCRUBBER AND TRAY TOWER ABSORBER, REMOVES 70% OF THE INLET SO2. REHEAT IS SUPPLIED BY FLUE GAS BYPASS. THE SCRUBBING WASTES ARE DISCHARGED TO AN ON-SITE, UNLINED DIKED POND. THE NO. 2 UNIT COMMENCED INITIAL OPERATION IN JULY 1977.
SOUTH CAROLINA PUBLIC SERVICE WINYAH 3 NEW 300.0 MW (GROSS) 300.0 MW (ESC) COAL 1.70 %S LIMESTONE BABCOCK & WILCOX ENERGY CONSUMPTION: ****% STATUS 3 STARTUP 5/80	A CONTRACT HAS BEEN AWARDED TO BABCOCK & WILCOX FOR THE INSTALLATION OF THE FGD SYSTEM ON THIS UNIT. PARTICULATE REMOVAL WILL BE PROVIDED BY RESEARCH COTTRELL ESP'S. THE BOILER IS A COAL-FIRED DRY-BOTTOM UNIT WHICH WILL BURN COAL WITH A 1.7% SULFUR CONTENT AND A HEAT VALUE OF 11,500 BTU/LB. THE GENERATING EQUIPMENT IS BEING SUPPLIED BY RILEY STOKER. 100% OF THE FLUE GAS WILL BE SCRUBBED. ALL FGD FOOTINGS HAVE BEEN POURED AND BOILER STRUCTURAL STEEL WORK IS NEARLY COMPLETE.
SOUTHERN CALIFORNIA EDISON ALAMITOS 6 RETROFIT 480.0 MW (GROSS) 175.0 MW (ESC) OIL .25 %S LIME SO. CALIFRONIA EDISON/STEARNS ENERGY CONSUMPTION: ****% STATUS 3 STARTUP 1/82	AS A RESULT OF AN "EMISSION OFFSET" AGREEMENT, STANDARD OIL OF OHIO HAS CONTRACTED SCE AND STEARNS AND RODGERS TO INSTALL A LIME SCRUBBING SYSTEM ON ITS EXISTING ALAMITOS 6 UNIT. THE FGD SYSTEM WILL TREAT ONE THIRD OF THE FLUE GAS WITH HORIZONTAL WEIR MODULES. REHEAT WILL BE PROVIDED BY THE BALANCE OF THE FLUE GAS. THE SLUDGE WILL BE DEWATERED BY CENTRIFUGES OR DISC DRYERS AND HAULED TO AN OFFSITE LANDFILL.
SOUTHERN ILLINOIS POWER COOP MARION 4 NEW 184.0 MW (GROSS) 184.0 MW (ESC) COAL 3.00 %S LIMESTONE BABCOCK & WILCOX ENERGY CONSUMPTION: ***.% STATUS 2 STARTUP 5/79	THE EMISSION CONTROL SYSTEM FOR THIS NEW COAL-FIRED BOILER CONSISTS OF AN ESP FOR PARTICULATE CONTROL FOLLOWED BY 2 SPRAY TOWERS FOR SO2 CONTROL. LIMESTONE SLURRY WILL BE USED AS THE SCRUBBING REAGENT. SIPC IS NOT PLANNING TO UTILIZE FLUE GAS REHEAT AND IS CURRENTLY PLANNING ON A BRICK LINING FOR THE STACK. SIPC INTENDS TO USE A LANDFILL WITH ASH STABILIZATION FOR SLUDGE DISPOSAL. CONSTRUCTION IS NEARLY 100% COMPLETE AND THE SYSTEM HAS BEEN AIR TESTED. THE BOILER IS NOW OPERATING. THE FGD SYSTEM WILL START IN MAY.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	ABSTRACT
SOUTHERN ILLINOIS POWER COOP MARION 5 NEW 300.0 MW (GROSS) 300.0 MW (ESC) COAL 3.00 %S PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 0/84	SOUTHERN ILLINOIS POWER COOP IS PLANNING A NEW COAL-FIRED UNIT FOR ITS MARION STATION, MARION 5. THE FGD PROCESS HAS NOT BEEN DECIDED. THE UNIT WILL FIRE 3.0% SULFUR COAL AND MAY START UP AS EARLY AS 1983. THE UTILITY IS WAITING FOR THE FINALIZATION OF THE SO2 REGULATIONS THEY WILL HAVE TO MEET.
SOUTHERN INDIANA GAS & ELEC A.B. BROWN 1 NEW 265.0 MW (GROSS) 265.0 MW (ESC) COAL 3.75 %S DUAL ALKALI FMC CORPORATION ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 3/79	THE UTILITY HAS AWARDED A CONTRACT TO FMC FOR THE INSTALLATION OF A DOUBLE ALKALI SCRUBBING SYSTEM UTILIZING SODA ASH AND LIME. THIS UNIT IS A PART OF A NEW POWER STATION LOCATED IN WEST FRANKLIN, INDIANA. THE SYSTEM WILL PRODUCE A FILTER CAKE WASTE PRODUCT WHICH WILL BE DISPOSED OF IN AN ON-SITE LANDFILL. THE PARTICULATE EMISSIONS WILL BE CONTROLLED BY A BUELL-ENVIROTECH COLD-SIDE ESP. THE CONSTRUCTION WORK AND ENGINEERING IS APPROXIMATELY 78% COMPLETE. THE FGD SYSTEM IS ESSENTIALLY COMPLETE.
SOUTHERN MISSISSIPPI ELECTRIC R.D. MORROW 1 NEW 200.0 MW (GROSS) 124.0 MW (ESC) COAL 1.00 %S LIMESTONE RILEY STOKER/ENVIRONEERING ENERGY CONSUMPTION: ****% STATUS 1 STARTUP 8/78	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. PARTICULATES WILL BE CONTROLLED BY A HIGH-EFFICIENCY ESP UPSTREAM OF THE FGD SYSTEM. DESIGN SO2 AND PARTICULATE REMOVAL EFFICIENCIES ARE 85 AND 99.6%, RESPECTIVELY. A WATER SPRAY HAS BEEN ADDED IN THE BY-PASS DUCT TO PROTECT THE LINER FROM TEMPERATURE EXCURSION. SLUDGE WILL BE STABILIZED WITH FLYASH AND DISPOSED OF ON-SITE. INITIAL STARTUP HAS BEGUN, HOWEVER DUE TO BOILER PROBLEMS NO OPERATING TIME HAS BEEN ACCUMULATED. ACCEPTANCE TESTING IS EXPECTED IN NOVEMBER.
SOUTHERN MISSISSIPPI ELECTRIC R.D. MORROW 2 NEW 200.0 MW (GROSS) 124.0 MW (ESC) COAL 1.00 %S LIMESTONE RILEY STOKER/ENVIRONEERING ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 5/79	A CONTRACT WAS AWARDED BY SME TO RILEY STOKER/ENVIRONEERING FOR THIS FGD SYSTEM. PARTICULATES WILL BE CONTROLLED BY A HIGH-EFFICIENCY ESP UPSTREAM OF THE FGD SYSTEM. DESIGN SULFUR DIOXIDE AND PARTICULATE EFFICIENCIES ARE 85 AND 99.6 PERCENT, RESPECTIVELY. A WATER SPRAY HAS BEEN ADDED IN THE BY-PASS DUCT TO PROTECT THE LINER FROM TEMPERATURE EXCURSION. SLUDGE WILL BE STABILIZED WITH FLYASH AND DISPOSED ON THE PLANT SITE. CONSTRUCTION OF THE WET LIMESTONE SCRUBBING SYSTEM IS NOW IN ITS FINAL STAGES. THE BOILER IS NOW IN OPERATION.
SOUTHWESTERN ELECTRIC POWER HENRY W. PERKEY 1 NEW 720.0 MW (GROSS) 720.0 MW (ESC) COAL .80 %S LIGNITE LIMESTONE AIR CORRECTION DIVISION, UOP ENERGY CONSUMPTION: ****% STATUS 3 STARTUP 2/84	A CONTRACT FOR THE EMISSION CONTROL SYSTEM HAS BEEN AWARDED TO THE AIR CORRECTION DIVISION OF UOP. THE SYSTEM DESIGN INCLUDES TWO COLD-SIDE ESP'S FOR PARTICULATE REMOVAL UP-STREAM FROM 4 SPRAY TOWERS WHICH UTILIZE LIMESTONE SLURRY FOR SO2 CONTROL. SLUDGE DISPOSAL WILL BE HANDLED BY AN IUCS SYSTEM. START-UP IS EXPECTED BY FEBRUARY 1984.
SPRINGFIELD CITY UTILITIES SOUTHWEST 1 NEW 194.0 MW (GROSS) 194.0 MW (ESC) COAL 3.50 %S BITUMINOUS LIMESTONE AIR CORRECTION DIVISION, UOP ENERGY CONSUMPTION: 4.6% STATUS 1 STARTUP 4/77	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE EMISSION CONTROL SYSTEM FOR THIS NEW COAL-FIRED UNIT CONSISTS OF A FOUR-FIELD HIGH EFFICIENCY ESP (99.6% DESIGN) AND 2 TURBULENT CONTACT ABSORBER MODULES (80% DESIGN) FOR THE CONTROL OF PARTICULATES AND SO2. BOTH THE ESP AND LIMESTONE FGD SYSTEM ARE SUPPLIED BY UOP. THE SCRUBBING WASTES ARE DEWATERED BY A ROTARY DRUM VACUUM FILTER AND THE FILTER CAKE IS HAULED AWAY TO A LANDFILL. INITIAL OPERATION OF THE FGD SYSTEM OCCURRED IN APRIL 77. IN SEPT. 77, THE UNIT SUCCESSFULLY COMPLETED COMPLIANCE TESTING.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	ABSTRACT
SPRINGFIELD WATER, LIGHT & PWR DALLMAN 3 NEW 205.0 MW (GROSS) 205.0 MW (ESC) COAL 3.70 %S LIMESTONE RESEARCH COTTRELL ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 8/80	A CONTRACT WAS AWARDED TO RESEARCH COTTRELL FOR THE INSTALLATION OF A LIMESTONE FGD SYSTEM. REQUIRED SULFUR DIOXIDE REMOVAL EFFICIENCY IS 90 PERCENT. A SLUDGE DISPOSAL STRATEGY HAS NOT BEEN FINALIZED, BUT THE UTILITY IS CONSIDERING EITHER PONDING OR LANDFILL. CONSTRUCTION OF THE FGD SYSTEM FOUNDATIONS HAVE BEGUN. ALL SYSTEMS ARE ON SCHEDULE. THE BOILER OPERATION WAS SCHEDULED TO COMMENCE IN JUNE 1978.
ST. JOE ZINC G.F. WEATON 1 RETROFIT 60.0 MW (GROSS) 60.0 MW (ESC) COAL 3.00 %S CITRATE BUREAU OF MINES ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 4/79	CONSTRUCTION CONTINUES ON THE CITRATE PROCESS SCRUBBING SYSTEM WHICH WILL CONTROL SO2 EMISSIONS FROM A 60-MW COAL-FIRED POWER GENERATING UNIT AT ST. JOE ZINC. THIS UNIT PROVIDES POWER FOR THE LOCAL UTILITY GRID. FGD SYSTEM START-UP IS SCHEDULED FOR DECEMBER 1978. THE REGENERABLE FGD SYSTEM WILL PRODUCE ELEMENTAL SULFUR AS A BY-PRODUCT. ALL MAJOR CONSTRUCTION IS COMPLETE. WIRING AND PIPING WORK IS NOW BEING COMPLETED.
TAMPA ELECTRIC BIG BEND 4 NEW 450.0 MW (GROSS) 450.0 MW (ESC) COAL 2.50 %S PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 0/85	TAMPA ELECTRIC HAS ANNOUNCED PLANS TO INSTALL AN FGD SYSTEM AT BIG BEND 4 WHICH IS SCHEDULED TO BEGIN OPERATIONS EARLY IN 1985. THE FGD PROCESS HAS NOT YET BEEN SELECTED. PRIMARY PARTICULATE CONTROL WILL BE PROVIDED BY AN ELECTROSTATIC PRICIPITATOR UPSTREAM OF THE FGD SYSTEM. AN INDIRECT (STEAM COIL) HOT AIR INJECTION REHEAT SYSTEM WILL BE INCLUDED AT THE SCRUBBER OUTLET. DESIGN SULFUR DIOXIDE REMOVAL EFFICIENCY WILL BE 90 PERCENT
TENNESSEE VALLEY AUTHORITY CUMBERLAND RETROFIT 1300.0 MW (GROSS) 600.0 MW (ESC) COAL ***** %S BITUMINOUS PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 7/82	TVA INSTALLING A HEAVY-MEDIA COAL-CLEANING SYSTEM AND HAS AGREED TO INSTALL A 600-MW FGD SYSTEM AT THE CUMBERLAND PLANT TO BRING IT INTO COMPLIANCE WITH STATE AND FEDERAL SO2 EMISSION LIMITS. THE TYPE OF FGD SYSTEM CHOSEN WILL BE DETERMINED BY PROTOTYPE LEVEL EVALUATION OF SEVERAL ADVANCED SCRUBBER CONCEPTS.
TENNESSEE VALLEY AUTHORITY JOHNSONVILLE 1-10 RETROFIT 1450.0 MW (GROSS) 600.0 MW (ESC) COAL ***** %S MAGNESIUM OXIDE TVA/UNITED ENGINEERS ENERGY CONSUMPTION: ****% STATUS 5 STARTUP 0/82	TVA IS PLANNING TO RETROFIT A 600-MW MAGNESIUM OXIDE FGD SYSTEM AT THE JOHNSONVILLE STEAM PLANT, A 1500-MW COAL-FIRED STATION. ENGINEERING ASSISTANCE WILL BE PROVIDED BY UNITED ENGINEERS. THIS PROJECT IS BUDGETTED AT $185 MILLION, INCLUDING THE COST OF A NEW 600-FT. STACK.
TENNESSEE VALLEY AUTHORITY PARADISE 1 RETROFIT 704.0 MW (GROSS) 704.0 MW (ESC) COAL ***** %S LIMESTONE VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 3 STARTUP 0/82	TVA IS REQUESTING/EVALUATING BID SPECIFICATIONS FOR TWO LIMESTONE SLURRY FGD SYSTEMS WHICH WILL BE RETROFITTED ONTO TWO 650-MW HIGH SULFUR COAL-FIRED BOILERS AT THIS STATION. THE FGD SYSTEMS WILL TREAT 100% OF THE FLUE GASES FROM BOTH UNITS. TVA HAS PROJECTED THE TOTAL COST OF THE PARADISE FGD SYSTEMS TO BE APPROXIMATELY $220 MILLION ($170/KW). BID REQUEST WAS COMPLETED BY MID-NOVEMBER AND EVALUATION IS NOW IN PROCESS. BID EVALUATION IS EXPECTED TO BE COMPLETED BY JANUARY 1 AND A CONTRACT SHOULD BE AWARDED SHORTLY THEREAFTER.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	ABSTRACT
TENNESSEE VALLEY AUTHORITY PARADISE 2 RETROFIT 704.0 MW (GROSS) 704.0 MW (ESC) COAL 4.20 %S LIMESTONE VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 3 STARTUP 4/82	TVA IS REQUESTING/EVALUATING BID SPECIFICATIONS FOR TWO LIMESTONE SLURRY FGD SYSTEMS WHICH WILL BE RETROFITTED ONTO TWO 650-MW HIGH SULFUR COAL-FIRED BOILERS AT THIS STATION. THE FGD SYSTEMS WILL TREAT 100% OF THE FLUE GASES FROM BOTH UNITS. TVA HAS PROJECTED THE TOTAL COST OF THE PARADISE FGD SYSTEMS TO BE APPROXIMATELY $220 MILLION ($170/KW). BID REQUEST WAS COMPLETED BY MID-NOVEMBER AND EVALUATION IS NOW IN PROCESS. BID EVALUATION IS EXPECTED TO BE COMPLETED BY JANUARY 1 AND A CONTRACT SHOULD BE AWARDED SHORTLY THEREAFTER.
TENNESSEE VALLEY AUTHORITY SHAWNEE 10A RETROFIT 10.0 MW (GROSS) 10.0 MW (ESC) COAL 2.90 %S BITUMINOUS LIME/LIMESTONE AIR CORRECTION DIVISION, UOP ENERGY CONSUMPTION: ****% STATUS 1 STARTUP 4/72	REFER TO THE BACKGROUND INFORMATION IN SECTION 3 OF THIS REPORT. THIS TURBULENT CONTACT ABSORBER (TCA) LIME/LIMESTONE SCRUBBING SYSTEM HAS BEEN OPERATIONAL SINCE APRIL 1972. THIS TEST PROGRAM IS FUNDED BY THE EPA WITH TVA AS THE CONSTRUCTOR AND FACILITY OPERATOR. THE BECHTEL CORP. OF SAN FRANCISCO IS THE MAJOR CONTRACTOR, TEST DIRECTOR, AND REPORT WRITER. TESTING CHEMICAL ADDITIVES FOR IMPROVING SO2 REMOVAL EFFICIENCY CONTINUED THROUGH OCTOBER AND NOVEMBER. BOTH VENTURI/SPRAY TOWER AND TCA SYSTEMS WERE OPERATED ON LIMESTONE SLURRY WITH FLYASH LOADING.
TENNESSEE VALLEY AUTHORITY SHAWNEE 10B RETROFIT 10.0 MW (GROSS) 10.0 MW (ESC) COAL 2.90 %S BITUMINOUS LIME/LIMESTONE CHEMICO ENERGY CONSUMPTION: ****% STATUS 1 STARTUP 4/72	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THIS VENTURI/SPRAY TOWER LIME/LIMESTONE SCRUBBING SYSTEM HAS BEEN OPERATIONAL SINCE APRIL 1972. THIS TEST PROGRAM IS FUNDED BY THE EPA WITH TVA AS THE CONSTRUCTOR AND FACILITY OPERATOR. THE BECHTEL CORP. OF SAN FRANCISCO IS THE MAJOR CONTRACTOR, TEST DIRECTOR, AND REPORT WRITER. TESTING WITH CHEMICAL ADDITIVES FOR IMPROVING SO2 REMOVAL EFFICIENCY CONTINUED THROUGH OCTOBER AND NOVEMBER. BOTH VENTURI/SPRAY TOWER AND TCA SYSTEMS WERE OPERATED ON LIMESTONE SLURRY WITH HIGH FLYASH LOADING.
TENNESSEE VALLEY AUTHORITY WIDOWS CREEK 7 RETROFIT 575.0 MW (GROSS) 575.0 MW (ESC) COAL 3.70 %S BITUMINOUS LIMESTONE COMBUSTION ENGINEERING ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 10/80	TENNESSEE VALLEY AUTHORITY ANNOUNCED THAT A CONTRACT HAS BEEN AWARDED TO COMBUSTION ENGINEERING FOR A LIMESTONE SLURRY SPRAY TOWER FGD SYSTEM. THE FGD SYSTEM WILL TREAT HIGH SULFUR COAL FLUE GAS. THE SPRAY TOWER ABSORBERS WILL BE CONSTRUCTED OF 317L STAINLESS STEEL. THE NUMBER 7 UNIT FIRES COAL WITH THE SAME CHARACTERISTICS AS THE COAL FIRED IN UNIT 8. INITIAL OPERATIONS ARE SCHEDULED FOR OCTOBER 1980. THE FGD SYSTEM IS CURRENTLY UNDER CONSTRUCTION.
TENNESSEE VALLEY AUTHORITY WIDOWS CREEK 8 RETROFIT 550.0 MW (GROSS) 550.0 MW (ESC) COAL 4.30 %S LIMESTONE TENNESSEE VALLEY AUTHORITY ENERGY CONSUMPTION: ****% STATUS 1 STARTUP 5/77	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE EMISSION CONTROL SYSTEM FOR THIS 516 MW COAL-FIRED POWER GENERATING UNIT CONSISTS OF EXISTING ELECTROSTATIC PRECIPITATORS FOLLOWED BY FOUR PARALLEL SCRUBBING TRAINS, EACH CAPABLE OF HANDLING 25 PERCENT OF THE BOILER FLUE GAS FROM UNIT 8. EACH TRAIN INCLUDES A RECTANGULAR THROAT VENTURI SCRUBBER AND A GRID-TOWER ABSORBER SUPPLIED BY POLYCON. THE GRID TOWER CAN BE CONVERTED TO A MOBILE-BED TOWER IF GREATER SO2 REMOVAL IS REQUIRED.
TEXAS MUNICIPAL POWER AGENCY GIBBONS CREEK 1 NEW 400.0 MW (GROSS) 400.0 MW (ESC) COAL 1.06 %S LIGNITE LIMESTONE COMBUSTION ENGINEERING ENERGY CONSUMPTION: ****% STATUS 3 STARTUP 1/82	COMBUSTION ENGINEERING WAS AWARDED A CONTRACT TO DESIGN AND SUPPLY A 400-MW LIGNITE-FIRED BOILER, ESP, AND FGD SYSTEM AT GIBBONS CREEK STEAM ELECTRIC STATION UNIT NO. 1. THE BOILER WILL BURN 1.06% SULFUR LIGNITE. FLUE GAS WILL BE CLEANED OF PARTICULATES BY A COLD-SIDE ESP (99.73% EFFICIENCY). SO2 WILL BE REMOVED BY 3 SPRAY TOWER MODULES UTILIZING A LIMESTONE SLURRY (72.5 TO 87.5% EFFICIENCY). A CONTRACY HAS BEEN AWARDED TO IUCS FOR SLUDGE DISPOSAL. CONSTRUCTION IS TO BEGIN IN THE SPRING OF 1979. COMMERICAL START-UP IS SCHEDULED FOR JANUARY, 1982.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	ABSTRACT
TEXAS POWER & LIGHT SANDOW 4 NEW 545.0 MW (GROSS) 382.0 MW (ESC) COAL 1.60 %S LIGNITE LIMESTONE COMBUSTION ENGINEERING ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 7/80	COMBUSTION ENGINEERING HAS BEEN CHOSEN AS THE BOILER AND FGD VENDOR FOR THIS UNIT. BOILER CONSTRUCTION BEGAN ON SEPTEMBER 9, 1977. PARTICULATE REMOVAL EQUIPMENT WILL BE LOCATED ON THE COLD-SIDE OF THE AIR HEATER. SOME PORTION OF THE FLUE GAS WILL BYPASS THE SCRUBBER FOR REHEAT. THE SPENT SLURRY WILL BE PONDED AND WATER RECYCLED. -NULL--NULL--NULL--NULL--NULL--NULL--NULL--NULL--NULL--NULL--NULL--NULL--N
TEXAS POWER & LIGHT TWIN OAKS 1 NEW 750.0 MW (GROSS) 750.0 MW (ESC) COAL ***** %S LIGNITE LIMESTONE VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 8/83	THIS UNIT WILL BE JOINTLY OWNED BY TP&L AND ALCOA. A FIRM DECISION HAS NOT BEEN MADE WHETHER TO INSTALL FGD FACILITIES. THIS IS PRIMARILY DUE TO THE FACT THAT SUCH A DECISION IS NOT YET REQUIRED IN THE UTILITIES PLANNING TIMETABLE
TEXAS POWER & LIGHT TWIN OAKS 2 NEW 750.0 MW (GROSS) 750.0 MW (ESC) COAL ***** %S LIGNITE LIMESTONE VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 9/84	THIS UNIT WILL BE JOINTLY OWNED BY TP&L AND ALCOA. A FIRM DECISION HAS NOT BEEN MADE WHETHER TO INSTALL FGD FACILITIES. THIS IS PRIMARILY DUE TO THE FACT THAT SUCH A DECISION IS NOT YET REQUIRED IN THE UTILITIES PLANNING TIMETABLE
TEXAS UTILITIES FOREST GROVE 1 NEW 750.0 MW (GROSS) 750.0 MW (ESC) COAL ***** %S LIGNITE PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 5 STARTUP 0/81	TEXAS UTILITIES IS PLANNING A NEW 750-MW UNIT AT THE FOREST GROVE SITE. TWO ESP'S WILL BE INSTALLED FOR PARTICULATE CONTROL. THE UTILITY IS CURRENTLY REQUESTING BIDS FOR AN FGD SYSTEM. START-UP IS SCHEDULED FOR LATE 1981. THE BOILER WILL BE SUPPLIED BY BABCOCK & WILCOX COMPANY. THE DESIGN DOES NOT INCLUDE A STACK GAS REHEAT SYSTEM.
TEXAS UTILITIES MARTIN LAKE 1 NEW 793.0 MW (GROSS) 595.0 MW (ESC) COAL .90 %S LIGNITE LIMESTONE RESEARCH COTTRELL ENERGY CONSUMPTION: ****% STATUS 1 STARTUP 4/77	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THIS NEW 793 MW UNIT FIRES TEXAS LIGNITE CONTAINING 0.9% SULFUR (AVG) AND 8% ASH (AVG). THE UNIT IS EQUIPPED WITH AN EMISSION CONTROL SYSTEM WHICH INCLUDES COLD-SIDE ESP'S AND A LIMESTONE FGD SYSTEM BOTH SUPPLIED BY RESEARCH-COTTRELL. THE FGD SYSTEM CONSISTS OF 6 PACKED/SPRAY TOWER ABSORBERS WHICH TREAT 75% OF THE TOTAL BOILER FLUE GAS. THE REMAINING FLUE GAS IS BYPASSED FOR REHEAT. TOTAL SO2 REMOVAL EFFICIENCY IS 70.5%. THE FLUE GAS CLEANING WASTES ARE STABILIZED AND DISPOSED IN AN ON-SITE, LANDFILL.
TEXAS UTILITIES MARTIN LAKE 2 NEW 793.0 MW (GROSS) 595.0 MW (ESC) COAL .90 %S LIGNITE LIMESTONE RESEARCH COTTRELL ENERGY CONSUMPTION: ****% STATUS 1 STARTUP 5/78	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THIS NEW 793 MW UNIT FIRES TEXAS LIGNITE CONTAINING 0.9% SULFUR (AVG) AND 8% ASH (AVG). THE UNIT IS EQUIPPED WITH AN EMISSION CONTROL SYSTEM CONSISTING OF COLD-SIDE ESP'S AND A LIMESTONE FGD SYSTEM, BOTH SUPPLIED BY RESEARCH-COTTRELL. THE FGD SYSTEM CONSISTS OF 6 PACKED/SPRAY TOWER ABSORBERS WHICH TREAT 75% OF THE TOTAL BOILER FLUE GAS. THE REMAINING FLUE GAS IS BY-PASSED FOR REHEAT. TOTAL DESIGN SO2 REMOVAL EFFICIENCY IS 70.5%. THE FLUE GAS CLEANING WASTES ARE STABILIZED AND DISPOSED IN AN ON-SITE LANDFILL.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	ABSTRACT
TEXAS UTILITIES MARTIN LAKE 3 NEW 793.0 MW (GROSS) 595.0 MW (ESC) COAL .90 %S LIGNITE LIMESTONE RESEARCH COTTRELL ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 2/79	THIS NEW 793-MW POWER GENERATING UNIT WILL FIRE TEXAS LIGNITE CONTAINING 0.9% SULFUR (AVG.) AND 8% ASH (AVG.). TO MEET FEDERAL NSPS, THE BE EQUIPPED WITH AN EMISSION CONTROL SYSTEM CONSISTING OF COLD-SIDE ESP'S AND A LIMESTONE FGD SYSTEM, BOTH SUPPLIED BY RESEARCH-COTTRELL. THE FGD SYSTEM CONSISTS OF 6 PACKED/SPRAY TOWER ABSORBERS WHICH WILL TREAT 75% OF THE TOTAL BOILER FLUE GAS. THE REMAINING GAS WILL BE BYPASSED FOR REHEAT. TOTAL DESIGN SO2 REMOVAL EFFICIENCY IS 70.5% THE FLUE GAS CLEANING WASTES WILL BE STABILIZED AND DISPOSED IN AN ON-SITE LANDFILL.
TEXAS UTILITIES MARTIN LAKE 4 NEW 750.0 MW (GROSS) 750.0 MW (ESC) COAL .90 %S LIGNITE LIMESTONE RESEARCH COTTRELL ENERGY CONSUMPTION: ****% STATUS 3 STARTUP 0/85	THE CONTRACT FOR THIS FGD SYSTEM HAS BEEN AWARDED TO RESEARCH-COTTRELL. THE BOILER IS NOW BEING ERECTED. START-UP HAS BEEN DELAYED TO EITHER 1985 OR 1986.
TEXAS UTILITIES MILL CREEK 1 NEW 750.0 MW (GROSS) 750.0 MW (ESC) COAL ***** %S LIGNITE PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 0/85	TEXAS UTILITIES IS PLANNING TWO NEW 750-MW UNITS FOR THE UTILITY'S MILL CREEK SITE. THE UTILITY WILL INCORPORATE FGD SYSTEMS ON EACH UNIT SO THAT SO2 EMISSIONS WILL BE CONTROLLED TO APPROXIMATELY 1LB/MM BTU. PARTICULATE MATTER WILL BE CONTROLLED BY ESP'S. START-UP FOR UNITS 1 AND2 ARE PROJECTED TO BE 1985 AND 1986 RESPECTIVELY.
TEXAS UTILITIES MILL CREEK 2 NEW 750.0 MW (GROSS) 750.0 MW (ESC) COAL ***** %S LIGNITE PROCESS NOT SELECTED VENDOR NOT SELECTED ENERGY CONSUMPTION: ****% STATUS 6 STARTUP 0/86	TEXAS UTILITIES IS PLANNING TWO NEW 750-MW UNITS FOR THE UTILITY'S MILL CREEK SITE. THE UTILITY WILL INCORPORATE FGD SYSTEMS ON EACH UNIT SO THAT SO2 EMISSIONS WILL BE CONTROLLED TO APPROXIMATELY 1 LB/MM BTU. PARTICULATE MATTER WILL BE CONTROLLED BY ESP'S. START-UP FOR UNITS 1 AND 2 ARE PROJECTED TO BE 1985 AND 1986 RESPECTIVELY.
TEXAS UTILITIES MONTICELLO 3 NEW 800.0 MW (GROSS) 800.0 MW (ESC) COAL 1.50 %S LIGNITE LIMESTONE CHEMICO ENERGY CONSUMPTION: ****% STATUS 1 STARTUP 5/78	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE EMISSION CONTROL SYSTEM FOR THIS UNIT CONSISTS OF A HIGH EFFICIENCY ESP AND A LIMESTONE FGD SYSTEM. THE ESP (POLLUTION CONTROL-WALTHER) PROVIDES PRIMARY PARTICULATE CONTROL (99.56%). THE FGD SYSTEM CONSISTS OF 3 LIMESTONE SCRUBBING SPRAY TOWERS THAT PROVIDE PRIMARY SO2 CONTROL (74%). THE FGD SYSTEM IS DESIGNED TO TREAT 3 MM ACFM OF FLUE GAS RESULTING FROM COAL WITH 1.5% SULFUR, 18.9% ASH AND 0.04% CL. THE FLUE GAS CLEANING WASTES ARE DISPOSED IN AN ON-SITE LINED POND.
UTAH POWER & LIGHT EMERY 1 NEW 400.0 MW (GROSS) 360.0 MW (ESC) COAL .50 %S LIME CHEMICO ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 4/79	A CONTRACT HAS BEEN AWARDED TO THE CHEMICO AIR POLLUTION DIVISION FOR A PEBBLE LIME WET SCRUBBING SYSTEM FOR THIS NEW UNIT. THE SCRUBBING SYSTEM IS DESIGNED TO OPERATE IN AN OPEN WATER LOOP MODE WITH AN SO2 REMOVAL EFFICIENCY OF 80 PERCENT FOR LOW SULFUR UTAH COAL. PRIMARY PARTICULATE CONTROL WILL BE PROVIDED BY AN ESP UPSTREAM OF THE SCRUBBERS. THE SLUDGE WILL BE STABILIZED WITH FLYASH AND DISPOSED OF ON THE PLANT SITE. THE A-E DESIGN FIRM FOR THIS PROJECT IS STEARNS-ROGER. CONSTRUCTION IS NOW IN ITS FINAL STAGES.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	ABSTRACT
UTAH POWER & LIGHT EMERY 2 NEW 400.0 MW (GROSS) 360.0 MW (ESC) COAL .50 %S LIME CHEMICO ENERGY CONSUMPTION: ****% STATUS 2 STARTUP 6/80	UTAH P&L AWARDED CHEMICO A CONTRACT TO SUPPLY A LIME FGD SYSTEM FOR EMERY 2 DESIGNED TO OPERATE IN AN OPEN WATER LOOP MODE WITH AN SO2 REMOVAL EFFICIENCY OF 80 PERCENT (FIRING LOW SULFUR UTAH COAL). PRIMARY PARTICULATE CONTROL WILL BE PROVIDED BY AN ESP UP-STREAM OF THE SCRUBBERS. THE SLUDGE WILL BE STABILIZED WITH FLYASH AND DISPOSED OF ON THE PLANT SITE. INITIAL BOILER AND FGD SYSTEM START-UP IS SCHEDULED FOR JUNE 1980. THIS UNIT WILL BE IDENTICAL TO UNIT 1. CONSTRUCTION ON THIS UNIT IS ABOUT 35% COMPLETE.
UTAH POWER & LIGHT HUNTINGTON 1 NEW 430.0 MW (GROSS) 366.0 MW (ESC) COAL .50 %S LIME CHEMICO ENERGY CONSUMPTION: ****% STATUS 1 STARTUP 5/78	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. CHEMICO WAS THE SUPPLIER OF A LIME SCRUBBING SYSTEM FOR THIS NEW UNIT. PRIMARY PARTICULATE REMOVAL IS PROVIDED BY AN ESP INSTALLED UPSTREAM OF THE WET SCRUBBING SYSTEM. A DAMPER IS USED DURING OPERATION TO ALLOW BETWEEN 10 AND 20 PERCENT OF THE FLUE GAS TO BY-PASS THE FGD SYSTEM. DESIGN REMOVAL EFFICIENCIES FOR SO2 AND PARTICULATE ARE 90 AND 99.5 PERCENT RESPECTIVELY. SLUDGE IS DEWATERED (60% SOLIDS) AND TRUCKED TO AN ON-SITE LANDFILL. INITIAL OPERATIONS AT THIS UNIT BEGAN ON MAY 10, 1978.
WISCONSIN POWER & LIGHT COLUMBIA 2 NEW 527.0 MW (GROSS) 316.0 MW (ESC) COAL .80 %S LIME/ALKALINE FLYASH CHEMICO ENERGY CONSUMPTION: ****% STATUS 3 STARTUP 1/80	A CONTRACT HAS BEEN AWARDED TO CHEMICO FOR A LIME/FLYASH FGD SYSTEM. IT WILL CONSIST OF TWO SPRAY MODULES WITH A HOT-SIDE ESP FOR PARTICULATE REMOVAL. A CLOSED LOOP WATER SYSTEM IS ANTICIPATED WITH FLYASH STABILIZATION OF THE SLUDGE. A SLUDGE DISPOSAL POND LOCATED OFF-SITE IS BEING CONSIDERED. THE FGD SYSTEM IS BEING DESIGNED TO TREAT 60% OF THE FLUE GAS RESULTING FROM THE COMBUSTION OF LOW SULFUR COLSTRIP COAL. THE REMAINING 40% WILL BE BYPASSED FOR REHEAT.

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

COMPANY NAME	ALABAMA ELECTRIC COOP	
PLANT NAME	TOMBIGBEE	
UNIT NUMBER	2	
CITY	LEROY	
STATE	ALABAMA	
REGULATORY CLASSIFICATION	A	
PARTICULATE EMISSION LIMITATION - NG/J	******	(****** LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J	516.	(1.200 LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW	*******	
GROSS UNIT GENERATING CAPACITY - MW	255.0	
NET UNIT GENERATING CAPACITY W/FGD - MW	225.0	
NET UNIT GENERATING CAPACITY WO/FGD - MW	*******	
EQUIVALENT SCRUBBED CAPACITY - MW	179.0	
** BOILER DATA		
SUPPLIER	RILEY STOKER	
TYPE	PULVERIZED	
SERVICE LOAD	BASE	
COMMERCIAL SERVICE DATE	6/79	
MAXIMUM BOILER FLUE GAS FLOW - CU.M/S	449.72	(953000 ACFM)
FLUE GAS TEMPERATURE - C	143.9	(291 F)
STACK HEIGHT - M	122.	(400 FT)
STACK TOP DIAMETER - M	*******	(***** FT)
** FUEL DATA		
FUEL TYPE	COAL	
FUEL GRADE	BITUMINOUS	
AVERAGE HEAT CONTENT - KJ/KG	*******	(****** BTU/LB)
RANGE HEAT CONTENT - BTU/LB		11000-12000
AVERAGE ASH CONTENT - %	********	
RANGE ASH CONTENT - %	10-16	
AVERAGE MOISTURE CONTENT - %	********	
RANGE MOISTURE CONTENT - %	******	
AVERAGE SULFUR CONTENT - %	1.15	
RANGE SULFUR CONTENT - %	0.8-1.5	
AVERAGE CHLORIDE CONTENT - %	********	
RANGE CHLORIDE CONTENT - %	******	
FUEL FIRING RATE - M T/H	*******	(*** TPH)
FUEL FIRING RATE - MW	*****	
** ESP		
NUMBER	1	
TYPE	HOT SIDE	
SUPPLIER	RESEARCH-COTTRELL	
PARTICULATE DESIGN REMOVAL EFFICIENCY - %	99.3	
** FGD SYSTEM		
SALEABLE PRODUCT/THROWAWAY PRODUCT	THROWAWAY PRODUCT	
GENERAL PROCESS TYPE	WET SCRUBBING	
PROCESS TYPE	LIMESTONE	
SYSTEM SUPPLIER	PEABODY PROCESS SYSTEMS	
A-E FIRM	BURNS & MCDONALD	
DEVELOPMENT LEVEL	FULL SCALE	
NEW/RETROFIT	NEW	
PARTICULATE DESIGN REMOVAL EFFICIENCY - %	99.30	
SO2 DESIGN REMOVAL EFFICIENCY - %	59.50	
INITIAL START-UP	9/78	
CONTRACT AWARDED	8/75	
** ABSORBER		
NUMBER	2	
TYPE	SIEVE TRAY SPRAY TOWER	
INITIAL START UP	9/78	
SHELL MATERIAL	CARBON STEEL	
SHELL LINER MATERIAL	316L SS	
INTERNAL MATERIAL	316 SS	
BOILER LOAD/ABSORBER - %	35.0	
LIQUID RECIRCULATION RATE - LITER/S	1259.	(19980 GPM)
L/G RATIO - L/CU.M	9.4	(70.0 GAL/1000ACF)
SO2 DESIGN REMOVAL EFFICIENCY - %	85.0	
** FANS		
NUMBER	1	
TYPE	ID, DIRECT COUPLED	
CONSTRUCTION MATERIALS	CARBON STEEL	

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

** MIST ELIMINATOR

NUMBER	1
TYPE	CHEVRON

** PUMPS

SERVICE	NUMBER
RECYCLE	6
MILL RECYCLE	2
LIMESTONE SLURRY	2
WASH WATER	3
WASTE SLURRY	2
SUPERNATE RETURN	1

** TANKS

SERVICE	NUMBER
SLURRY RECYCLE	1
LIMESTONE SLURRY STORAGE	1
WASHWATER	1

** REHEATER

NUMBER	1

** THICKENER

NUMBER	1

** WATER LOOP

TYPE	OPEN	
FRESH MAKEUP WATER ADDITION - LITERS/S	17.6	(280 GPM)

** REAGENT PREPARATION EQUIPMENT

NUMBER OF BALL MILLS	1	
BALL MILL CAPACITY- M T/H	9.1	(10.0 TPH)

** TREATMENT

** DISPOSAL

NATURE	FINAL
TYPE	LINED POND
LOCATION	ON SITE
TRANSPORTATION	PIPE

PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
8/78	SYSTEM							744			
9/78	SYSTEM							720			

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 9/78 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 9/78 COMMENTS:
INITIAL OPERATION BEGAN DURING SEPTEMBER.
AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
10/78	SYSTEM							744			
11/78	SYSTEM							720			
12/78	SYSTEM							744			

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 12/78 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 1/79 COMMENTS:
THE UTILITY HAS REPORTED THAT THE UNIT HAS SUFFERED NO MAJOR PROBLEMS. OPERATIONAL HOURS ARE NOW BEING ACCUMULATED.
AFFECTED MODULES: SYS*

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
1/79	SYSTEM							744			

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

COMPANY NAME	ARIZONA ELECTRIC POWER COOP	
PLANT NAME	APACHE	
UNIT NUMBER	2	
CITY	COCHISE	
STATE	ARIZONA	
REGULATORY CLASSIFICATION	6	
PARTICULATE EMISSION LIMITATION - NG/J	43.	(.100 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J	344.	(.800 LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW	590.0	
GROSS UNIT GENERATING CAPACITY - MW	245.0	
NET UNIT GENERATING CAPACITY W/FGD - MW	200.0	
NET UNIT GENERATING CAPACITY WO/FGD - MW	*******	
EQUIVALENT SCRUBBED CAPACITY - MW	180.0	
** BOILER DATA		
SUPPLIER	RILEY STOKER	
TYPE	PULVERIZED COAL,DRY BOTTOM	
SERVICE LOAD	BASE	
COMMERCIAL SERVICE DATE	0/78	
MAXIMUM BOILER FLUE GAS FLOW - CU.M/S	*********	(******* ACFM)
FLUE GAS TEMPERATURE - C	*******	(**** F)
STACK HEIGHT - M	122.	(400 FT)
STACK TOP DIAMETER - M	*******	(***** FT)
** FUEL DATA		
FUEL TYPE	COAL	
FUEL GRADE	BITUMINOUS	
AVERAGE HEAT CONTENT - KJ/KG	*******	(****** BTU/LB)
RANGE HEAT CONTENT - BTU/LB		10000-11000
AVERAGE ASH CONTENT - %	10.00	
RANGE ASH CONTENT - %	******	
AVERAGE MOISTURE CONTENT - %	********	
RANGE MOISTURE CONTENT - %	******	
AVERAGE SULFUR CONTENT - %	.70	
RANGE SULFUR CONTENT - %	0.5-0.8	
AVERAGE CHLORIDE CONTENT - %	********	
RANGE CHLORIDE CONTENT - %	******	
FUEL FIRING RATE - M T/H	*******	(*** TPH)
FUEL FIRING RATE - MW	*****	
** ESP		
NUMBER	1	
TYPE	HOT SIDE	
SUPPLIER	AIR CORRECTION DIVISION, UOP	
PARTICULATE DESIGN REMOVAL EFFICIENCY - %	99.6	
** FGD SYSTEM		
SALEABLE PRODUCT/THROWAWAY PRODUCT	THROWAWAY PRODUCT	
GENERAL PROCESS TYPE	WET SCRUBBING	
PROCESS TYPE	LIMESTONE	
SYSTEM SUPPLIER	RESEARCH COTTRELL	
A-E FIRM	BURNS & MCDONALD	
DEVELOPMENT LEVEL	FULL-SCALE	
NEW/RETROFIT	NEW	
PARTICULATE DESIGN REMOVAL EFFICIENCY - %	99.50	
SO2 DESIGN REMOVAL EFFICIENCY - %	85.00	
COMMERCIAL DATE	11/78	
INITIAL START-UP	8/78	
CONSTRUCTION COMPLETION	8/78	
** ABSORBER		
NUMBER	2	
TYPE	PACKED TOWER	
INITIAL START UP	8/78	
NUMBER OF STAGES	1	
SHELL MATERIAL	MILD STEEL	
SHELL LINER MATERIAL	GLASS-FLEX	
NOZZLE TYPE	316 SS	
GAS FLOW - CU.M/S	188.76	(400000 ACFM)
GAS TEMPERATURE - C	132.2	(270 F)
LIQUID RECIRCULATION RATE - LITER/S	1260.	(20000 GPM)
PRESSURE DROP - KPA	.1	(.6 IN-H2O)
** MIST ELIMINATOR		
NUMBER	4	
TYPE	CHEVRON	

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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    CONFIGURATION                                   HORIZONTAL

 ** WATER LOOP
    TYPE                                            OPEN
    RECOVERED WATER RETURN - LITER/S                  340.2          ( 5400 GPM)
    FRESH MAKEUP WATER ADDITION - LITERS/S            115.9          ( 1840 GPM)

 ** DISPOSAL
    NATURE                                          FINAL
    TYPE                                            SLUDGE POND
    LOCATION                                        OFF-SITE ON LEASED LAND
    TRANSPORTATION                                  PUMPED
    DIMENSIONS                                      22 ACRES X 18 FT DEEP
    AREA - ACRES                                      22.0
    CAPACITY - CU.M                                   484308       (   396.0 ACRE-FT)

 ** DISPOSAL
    NATURE                                          FINAL
    TYPE                                            ASH POND
    LOCATION                                        OFF-SITE ON LEASED LAND
    TRANSPORTATION                                  PUMPED
    DIMENSIONS                                      64 ACRES X 18 FT DEEP
    AREA - ACRES                                      64.0
    CAPACITY - CU.M                                   1408896      (  1152.0 ACRE-FT)


-------------------------------------------PERFORMANCE DATA-------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
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10/78  SYSTEM                                                                744   303          58.1

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/78      EQUIPMENT: REAGENT HANDLING
            END DATE    11/78      PROBLEM: NOT DEFINED/SPECIFIED
                        THE LIMESTONE CRUSHER WAS UNABLE TO MEET ITS DESIGN CAPACITY.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    11/78      COMMENTS:
                        A COMPLIANCE TEST WAS COMPLETED BUT THE RESULTS ARE NOT YET AVAILABLE.
                        THE ACCEPTANCE IS SCHEDULED FOR THE BEGINNING OF 1979.
            AFFECTED MODULES: SYSTEM

11/78  A                            25.0                    17.0
       B                            44.0                    30.0
       SYSTEM                                                                720   488          80.7

12/78
       SYSTEM                                                                744   512

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/78      EQUIPMENT: RECYCLE PUMP
            END DATE     1/79      PROBLEM: NOT DEFINED/SPECIFIED
                         THE FGD SYSTEM WAS NOT IN SERVICE DURING DECEMBER OR JANUARY DUE TO
                         VARIOUS "DEBUGGING" PROBLEMS ESPECIALLY IN MAINTAINING RECYCLE PUMP OPER-
                         ATION.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     1/79      COMMENTS:
                         RESULTS OF A RECENT COMPLIANCE TEST INDICATED THAT SO2 EMISSIONS WERE
                         BETWEEN 1.2 LB/MM BTU, THE FEDERAL STANDARD, AND 0.8 LB/MM BTU, THE STATE
                         STANDARD, WITHOUT THE FGD SYSTEM.  THE UTILITY IS CURRENTLY BURNING LOW
                         SULFER COAL (0.6% S) AND THEY BELIEVE THAT THE STATE STANDARD COULD BE MET
                         WITHOUT FGD SYSTEM OPERATION WHEN THE FURNACE IS "FINE TUNED".
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/78      EQUIPMENT: PIPING
            END DATE     1/79      PROBLEM: COMPONENT FAILURE, OTHER
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

```
---------------------------------------------PERFORMANCE DATA------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                            A 30 HOUR OUTAGE OCCURRED DUE TO A RUPTURED PIPE.
                  AFFECTED MODULES: SYSTEM

 1/79                                                                       744   662
      SYSTEM
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

COMPANY NAME	ARIZONA PUBLIC SERVICE	
PLANT NAME	CHOLLA	
UNIT NUMBER	1	
CITY	JOSEPH CITY	
STATE	ARIZONA	
REGULATORY CLASSIFICATION	B	
PARTICULATE EMISSION LIMITATION - NG/J	85.	(.198 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J	430.	(1.000 LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW	615.0	
GROSS UNIT GENERATING CAPACITY - MW	119.0	
NET UNIT GENERATING CAPACITY W/FGD - MW	115.0	
NET UNIT GENERATING CAPACITY WO/FGD - MW	120.0	
EQUIVALENT SCRUBBED CAPACITY - MW	119.0	
** BOILER DATA		
SUPPLIER	COMBUSTION ENGINEERING	
TYPE	PULVERIZED COAL, WET BOTTOM	
SERVICE LOAD	BASE	
COMMERCIAL SERVICE DATE	0/62	
MAXIMUM BOILER FLUE GAS FLOW - CU.M/S	245.39	(520000 ACFM)
FLUE GAS TEMPERATURE - C	*******	(**** F)
STACK HEIGHT - M	78.	(256 FT)
STACK TOP DIAMETER - M	*******	(***** FT)
** FUEL DATA		
FUEL TYPE	COAL	
FUEL GRADE	SUBBITUMINOUS	
AVERAGE HEAT CONTENT - KJ/KG	23609.	(10150 BTU/LB)
RANGE HEAT CONTENT - BTU/LB		9650-10600
AVERAGE ASH CONTENT - %	13.50	
RANGE ASH CONTENT - %	9.7-22.5	
AVERAGE MOISTURE CONTENT - %	15.00	
RANGE MOISTURE CONTENT - %	******	
AVERAGE SULFUR CONTENT - %	.50	
RANGE SULFUR CONTENT - %	0.44-1.0	
AVERAGE CHLORIDE CONTENT - %	.02	
RANGE CHLORIDE CONTENT - %	0.01-0.04	
FUEL FIRING RATE - M T/H	49.0	(54 TPH)
FUEL FIRING RATE - MW	119	
** MECHANICAL COLLECTOR		
TYPE	CYCLONES	
SUPPLIER	RESEARCH COTTRELL	
PARTICULATE DESIGN REMOVAL EFFICIENCY - %	75.0	
** PARTICULATE SCRUBBER		
NUMBER	2	
TYPE	FLOODED DISC	
NUMBER OF STAGES	1	
SHELL MATERIAL	316L SS	
LINING MATERIAL	CEILCOTE AND FLAKEGLASS (LOWER PORTION)	
TYPE OF NOZZLES	TANGENTIAL	
BOILER LOAD/SCRUBBER - %	50.0	
FLUE GAS CAPACITY - CU.M/S	99.1	(210000 ACFM)
FLUE GAS TEMPERATURE - C	136.7	(278 F)
LIQUID RECIRCULATION RATE - LITER/S	136.7	(2170 GPM)
L/G RATIO - LITER/CU.M	1.4	(10.1 GAL/1000ACF)
PRESSURE DROP - KPA	3.7	(15 IN-H2O)
PARTICULATE INLET LOAD - G/CU.M	4.6	(2.00 GR/SCF)
PARTICULATE DESIGN REMOVAL EFFICIENCY - %	99.2	
** FGD SYSTEM		
SALEABLE PRODUCT/THROWAWAY PRODUCT	THROWAWAY PRODUCT	
GENERAL PROCESS TYPE	WET SCRUBBING	
PROCESS TYPE	LIMESTONE	
SYSTEM SUPPLIER	RESEARCH COTTRELL	
A-E FIRM	EBASCO	
DEVELOPMENT LEVEL	FULL-SCALE	
NEW/RETROFIT	RETROFIT	
PARTICULATE DESIGN REMOVAL EFFICIENCY - %	99.70	
SO2 DESIGN REMOVAL EFFICIENCY - %	58.50	
COMMERCIAL DATE	12/73	
INITIAL START-UP	10/73	
CONSTRUCTION COMPLETION	12/73	
CONTRACT AWARDED	7/71	
STARTED REQUESTING BIDS	4/71	

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    STARTED PRELIMINAY DESIGN                    1/71

 ** ABSORBER
    NUMBER                                       1
    TYPE                                        PACKED TOWER
    INITIAL START UP                            10/73
    SUPPLIER                                    RESEARCH COTTRELL
    NUMBER OF STAGES                             1
    DIMENSIONS                                  22 DIA X 70 HIGH
    SHELL MATERIAL                              316L SS
    INTERNAL MATERIAL                           316L SS
    NOZZLE TYPE                                 SPINNER VANE
    BOILER LOAD/ABSORBER - %                       50.0
    GAS FLOW - CU.M/S                             113.26        ( 240000 ACFM)
    GAS TEMPERATURE - C                           135.6         (  276 F)
    LIQUID RECIRCULATION RATE - LITER/S           630.          (10000 GPM)
    L/G RATIO - L/CU.M                              6.6         ( 49.0 GAL/1000ACF)
    PRESSURE DROP - KPA                              .1         (  .5 IN-H2O)
    SUPERFICAL GAS VELOCITY - M/SEC                 2.1         (  6.9 FT/S)
    PARTICULATE INLET LOAD - G/CU.M                 4.6         ( 1.995 GR/SCF)
    PARTICULATE OUTLET LOAD- G/CU.M                  .0         (  .001 GR/SCF)
    PARTICULATE REMOVAL EFFICIENCY - %             99.7
    SO2 INLET CONCENTRATION - PPM                 420
    SO2 OUTLET CONTRATION - PPM                   315
    SO2 DESIGN REMOVAL EFFICIENCY - %              25.0

 ** ABSORBER
    NUMBER                                       1
    TYPE                                        HOLLOW TOWER
    INITIAL START UP                            10/73
    SUPPLIER                                    RESEARCH COTTRELL
    NUMBER OF STAGES                             1
    DIMENSIONS                                  22 DIA X 70 HIGH
    SHELL MATERIAL                              316L SS
    INTERNAL MATERIAL                           316L SS
    NOZZLE TYPE                                 SPINNER VANE
    BOILER LOAD/ABSORBER - %                       50.0
    GAS FLOW - CU.M/S                             113.26        ( 240000 ACFM)
    GAS TEMPERATURE - C                           135.6         (  276 F)
    LIQUID RECIRCULATION RATE - LITER/S           630.          (10000 GPM)
    L/G RATIO - L/CU.M                              6.6         ( 49.0 GAL/1000ACF)
    PRESSURE DROP - KPA                              .1         (  .5 IN-H2O)
    SUPERFICAL GAS VELOCITY - M/SEC                 2.1         (  6.9 FT/S)
    PARTICULATE INLET LOAD - G/CU.M                 4.6         ( 1.995 GR/SCF)
    PARTICULATE OUTLET LOAD- G/CU.M                  .0         (  .001 GR/SCF)
    SO2 INLET CONCENTRATION - PPM                 420
    SO2 OUTLET CONTRATION - PPM                    35
    SO2 DESIGN REMOVAL EFFICIENCY - %              92.0

 ** FANS
    NUMBER                                       2
    TYPE                                        I.D.
    CONSTRUCTION MATERIALS                      MILD STEEL

 ** FANS
    NUMBER                                       2
    TYPE                                        I.D.
    CONSTRUCTION MATERIALS                      MILD STEEL

 ** MIST ELIMINATOR
    NUMBER                                       4
    TYPE                                        CHEVRON
    CONSTRUCTION MATERIAL                       POLYPROPYLENE
    CONFIGURATION                               HORIZONTAL
    NUMBER OF STAGES                               2
    NUMBER OF PASSES                               2
    FREEBOARD DISTANCE - M                         4.11        (13.5 FT)
    DEPTH - M                                       .30        ( 1.0 FT)
    VANE SPACING - CM                              3.8         ( 1.50 IN)
    VANE ANGLES                                 45 DEG.
    WASH SYSTEM                                 INTERMITTENT OVERSPRAY
    PRESSURE DROP - KPA                              .1        (  .5 IN-H2O)
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** MIST ELIMINATOR
     NUMBER                                        4
     TYPE                                         SLAT IMPINGEMENT
     CONSTRUCTION MATERIAL                        POLYPROPYLENE
     CONFIGURATION                                HORIZONTAL
     NUMBER OF STAGES                                2
     NUMBER OF PASSES                                4
     FREEBOARD DISTANCE - M                          4.11        (13.5 FT)
     DEPTH - M                                        .30        ( 1.0 FT)
     VANE SPACING - CM                              18.0         ( 7.10 IN)
     VANE ANGLES                                  45 DEG.
     WASH SYSTEM                                  INTERMITTENT OVERSPRAY
     PRESSURE DROP - KPA                               .1        (  .5 IN-H2O)

** PROCESS CONTROL CHEMISTRY
     CONTROL MANNER                               MANUAL

** PUMPS
     SERVICE                                      NUMBER
     -------                                      ------
     RECIRCULATION                                   1

** TANKS
     SERVICE                                      NUMBER
     -------                                      ------
     FLOODED DISC SCRUBBER TANK                      1
     SLUDGE HOLDUP TANK                              2
     ABSORBER TOWER HOLDUP TANK                      1
     LIMESTONE SLURRY MAKEUP TANK                    2

** REHEATER
     NUMBER                                        2
     TYPE                                         IN-LINE
     HEATING MEDIUM                               STEAM
     TEMPERATURE BOOST - C                          22.2         (   40 F)
     ENERGY REQUIRED                              8MM BTU/HR

** WATER LOOP
     TYPE                                         OPEN
     FRESH MAKEUP WATER ADDITION - LITERS/S          7.6         (  120 GPM)

** REAGENT PREPARATION EQUIPMENT
     NUMBER OF BALL MILLS                            1

** DISPOSAL
     NATURE                                       FINAL
     TYPE                                         UNLINED POND
     TRANSPORTATION                               PIPE
     DIMENSIONS                                   70-100 ACRES X 6 FT DEEP
     AREA - ACRES                                    85.0
     CAPACITY - CU.M                                 623730      (    510.0 ACRE-FT)


-------------------------------------------PERFORMANCE DATA--------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------

10/73  SYSTEM                                                                744

11/73  SYSTEM                                                                720

12/73  SYSTEM                                                                744

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  12/73      EQUIPMENT: REHEATER
             END DATE     4/74      PROBLEM: DESIGN-RELATED VIBRATION
                          BECAUSE OF A DIFFERENCE IN THE SIZE OF THE MAIN DUCT AND REHEATED TRANS-
                         ITION DUCT, THE GAS FLOW PRODUCES HARMONIC VIBRATIONS IN THE REHEATER.
                         THE VIBRATIONS WERE PARTIALLY DAMPENED BY INSTALLATION OF BAFFLES.
             AFFECTED MODULES: SYSTEM
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

PERFORMANCE DATA

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 12/73 EQUIPMENT: REHEATER
END DATE 4/74 PROBLEM: CHEMICAL-RELATED CORROSION

ONE OF THE REHEATER BUNDLES WAS BADLY CORRODED BY ACID THAT CONDENSED IN THE UNINSULATED DUCT UPSTREAM OF THE REHEATERS. THE TUBE BUNDLE WAS REPLACED AND A BAFFLE WAS INSTALLED TO DIVERT CONDENSED ACID FROM REHEATER TUBES.

AFFECTED MODULES: B

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 12/73 EQUIPMENT: DUCTWORK
END DATE 4/74 COMMENT: PREVENTIVE MAINTENANCE

THE DUCT UPSTREAM OF THE REHEATER WAS INSULATED. THE ACID CONDENSATION OCCURRED ONLY IN THE B-MODULE WHICH CONTAINS NO INTERNAL PACKING AND THERE FORE HAS A LOWER DEGREE OF SULFUR DIOXIDE REMOVAL (25 PERCENT).

AFFECTED MODULES: B

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 12/73 EQUIPMENT: PIPING
END DATE 4/74 PROBLEM: CHEMICAL-RELATED PLUGGING

SOME LINES PLUGGED, PARTICULARLY WHEN THE SYSTEM OPERATED AT LOW FLOW RATES.

AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 12/73 EQUIPMENT: RECYCLE PUMP
END DATE 4/74 PROBLEM: CHEMICAL-RELATED PLUGGING

SOLIDS SETTLED OUT IN STANDBY PUMPS, AND EXCESSIVE FAN VIBRATIONS OCCURRED BECAUSE OF ACCUMULATION OF SCALE BUILDUP WHEN THE UNIT WAS IDLE. TO SOLVE THESE PROBLEMS THE PACKING GLAND POSITION WAS REVERSED (INSTALLED UPSIDE DOWN), THE FAN WAS SANDBLASTED, THE PIPING WAS MODIFIED TO ELIMINATE STAGNANT POCKETS, AND PUMPS WERE FLUSHED IMMEDIATELY AFTER REMOVAL FROM SERVICE.

AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 12/73 EQUIPMENT: RECYCLE PUMP
END DATE **/** PROBLEM: CHEMICAL-RELATED PLUGGING

THE UTILITY EXPERIENCED SOLIDS BUILDUP IN THE FDS STUFFING GLAND BOX AND ON TOP OF THE SPRAY DOME.

AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
1/74	A			97.0							
	B			90.0							
	SYSTEM			94.0				744			
2/74	A			100.0							
	B			94.0							
	SYSTEM			97.0				672			
3/74	B			66.0							
	A			100.0							
	SYSTEM			83.0				744			
4/74	A			66.0							
	B			57.0							
	SYSTEM			62.0				720			
5/74	A		98.0								
	B			99.0							
	SYSTEM			99.0				744	744		
6/74	A			100.0							
	B			100.0							
	SYSTEM			100.0				720			

PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
7/74	A			97.0							
	B			92.0							
	SYSTEM			95.0				744			
8/74	A			97.0							
	B			97.0							
	SYSTEM			97.0				744			
9/74	B			99.0							
	A			95.0							
	SYSTEM			97.0				720			
10/74	A			83.0							
	B			68.0							
	SYSTEM			76.0				744			

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 10/74 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 10/74 COMMENTS:
ANNUAL BOILER AND FGD SYSTEM OVERHAUL.
AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
11/74	A			100.0							
	B			98.0							
	SYSTEM			99.0				720			
12/74	A			100.0							
	B										
	SYSTEM			100.0				744			
1/75	B			99.0							
	A			98.0							
	SYSTEM							744			

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 0/75 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 0/76 COMMENTS:
OPERATION OF THE SYSTEM THROUGHOUT 1975 AND 1976 WAS ACCOMPANIED BY A NUMBER OF MINOR PROBLEM AREAS INCLUDING: SIGNIFICANT CORROSION ATTACK IN THE VESSEL WALLS OF THE VENTURI FLOODED-DISC PARTICULATE SCRUBBER MODULE; ACID CORROSION IN THE B-SIDE REHEATER HOUSING; SCALE BUILDUP IN THE PIPE OUTLET AT THE SLUDGE/FLYASH EVAPORATION POND; PLUGGING IN THE SCRUBBER TOWER PACKING AND MIST ELIMINATOR; EROSION IN THE PUMPS; CORROSION IN THE BOILER EXHAUST ELBOW OF THE DUCTWORK LEADING FROM THE SCRUBBERS TO THE STACK.
AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
2/75	A			96.0							
	B			99.0							
	SYSTEM			98.0				672			
3/75	SYSTEM							744			
4/75	A			88.0							
	B			65.0							
	SYSTEM			77.0				720			
5/75	A			48.0							
	B			40.0							
	SYSTEM			44.0				744			

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 5/75 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 5/75 COMMENTS:
BOTH MODULES WERE OFF LINE FOR MOST OF THE MONTH FOR SCHEDULED REPAIRS AND CLEANING.
AFFECTED MODULES: A

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-----------------------------------------PERFORMANCE DATA-------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

 6/75  A                                    100.0
       B                                    100.0
       SYSTEM                               100.0                              720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   6/75     EQUIPMENT: ABSORBER
            END DATE     6/75     PROBLEM: CHEMICAL-RELATED PLUGGING
                         PLUGGING IN THE A-SIDE ABSORBER PACKING WAS OBSERVED.
            AFFECTED MODULES: A

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   6/75     EQUIPMENT: MIST ELIMINATOR
            END DATE     6/75     PROBLEM: CHEMICAL-RELATED PLUGGING
                         PLUGGING OCCURRED IN MIST ELIMINATORS.
            AFFECTED MODULES: A

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   6/75     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     6/75     COMMENTS:
                         NO MAJOR PROBLEMS WERE ENCOUNTERED DURING THE PERIOD.
            AFFECTED MODULES: SYSTEM

 7/75  A                                     97.0
       B                                     98.0
       SYSTEM                                98.0                              744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   7/75     EQUIPMENT: SCRUBBER
            END DATE     7/75     PROBLEM: DESIGN-RELATED FLOW DISTRIBUTION
                         MODULES WERE SHUT DOWN TO CLEAN FLOW RESTRICTIONS IN FLOODED-DISC RECIR-
                         CULATION LINES.
            AFFECTED MODULES: SYSTEM

 8/75  A                                     95.0
       B                                    100.0
       SYSTEM                                98.0                              744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/75     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     8/75     COMMENT: PREVENTIVE MAINTENANCE
                         THE A-SIDE WAS SHUT DOWN FOR INSPECTION.
            AFFECTED MODULES: A

 9/75  A                                     98.0
       B                                     97.0
       SYSTEM                                98.0                              720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/75     EQUIPMENT: SCRUBBER
            END DATE     9/75     PROBLEM: CHEMICAL-RELATED PLUGGING
                         MINOR OUTAGE RESULTED FROM PLUGGED FDS RECIRCULATION LINES
            AFFECTED MODULES: SYSTEM

10/75  A                                     84.0
       B                                     55.0
       SYSTEM                                70.0                              744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/75     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    10/75     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                         OUTAGES RESULTED FROM SCHEDULED EQUIPMENT OVERHAULS AND RECOATING OF VES-
                         SELS.
            AFFECTED MODULES: SYSTEM

11/75  A                                    100.0
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---------------------------------------------PERFORMANCE DATA---------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
       B                                  80.0
       SYSTEM                             90.0                                   720

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  11/75      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    11/75      COMMENTS:
                               NO MAJOR OUTAGES OR PROBLEMS OCCURRED DURING THE REPORT PERIOD.
             AFFECTED MODULES: SYSTEM

12/75  A                                 100.0
       B                                 100.0
       SYSTEM                            100.0                                   744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  12/75      EQUIPMENT: RECYCLE PUMP
             END DATE    12/75      PROBLEM: MECHANICAL-RELATED COMPONENT INEFFICIENCY
                               MINOR PROBLEMS ENCOUNTERED INCLUDED RECYCLE PUMP REBUILDING.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  12/75      EQUIPMENT: REAGENT HANDLING
             END DATE    12/75      PROBLEM: NOT DEFINED/SPECIFIED
                               THE B-SIDE REHEATER COIL MALFUNCTIONED.
             AFFECTED MODULES: B

 1/76  A                                  99.0
       B                                  99.0
       SYSTEM                             99.0                                   744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  1/76       EQUIPMENT: VALVES
             END DATE    1/76       PROBLEM: CHEMICAL-RELATED PLUGGING
                               MINOR VALVE PLUGGING OCCURRED.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  1/76       EQUIPMENT: PIPING
             END DATE    1/76
                               MINOR LINE PLUGGING OCCURRED.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  1/76       EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    1/76       COMMENTS:
                               MODULE B OPERATING HOURS WERE LOWER BECAUSE OF REDUCED SYSTEM REQUIREMENTS
             AFFECTED MODULES: SYSTEM

 2/76  SYSTEM                                                                    696

 3/76  SYSTEM                                                                    744

 4/76  B                                  98.0
       SYSTEM                             99.0                                   720

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  4/76       EQUIPMENT: DUCTWORK
             END DATE    4/76       PROBLEM: DESIGN-RELATED INFERIOR CONSTRUCTION MATERIAL
                               THE FGD SYSTEM IS CURRENTLY EXPERIENCEING COATING FAILURES IN THE ELBOW OF
                               THE SCRUBBER EXHAUST DUCT.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  4/76       EQUIPMENT: REAGENT HANDLING
             END DATE    4/76       PROBLEM: NOT DEFINED/SPECIFIED
                               THE UTILITY PERFORMED SOME MINOR REPAIRS TO THE HOUSING OF THE B-SIDE
                               REHEATER.
             AFFECTED MODULES: B
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------------------------------------------PERFORMANCE DATA---------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD    CAP.
                                                                SO2  PART. HOURS  HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

 5/76  A                                 76.0
       B                                100.0
       SYSTEM                            88.0                                744

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    5/76      EQUIPMENT: REHEATER
            END DATE      5/76      PROBLEM: CHEMICAL-RELATED CORROSION
                          THE A-SIDE EXPERIENCED SOME CORROSION AND PLUGGING PROBLEMS IN THE REHEAT-
                          ER TUBES.
            AFFECTED MODULES: A

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    5/76      EQUIPMENT: PUMP, OTHER
            END DATE      5/76      PROBLEM: NOT DEFINED/SPECIFIED
                          THE UTILITY REPORTED PLUGGING IN FDS LINES.
            AFFECTED MODULES: SYSTEM SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    5/76      EQUIPMENT: SCRUBBER
            END DATE      5/76      PROBLEM: CHEMICAL-RELATED PLUGGING
                          PLUGGING OCCURRED IN THE FDS PACKING.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    5/76      EQUIPMENT: MIST ELIMINATOR
            END DATE      5/76      PROBLEM: CHEMICAL-RELATED PLUGGING
                          PLUGGING OCCURRED IN THE MIST ELIMINATORS.
            AFFECTED MODULES: SYSTEM

 6/76  A                                 64.0
       B                                 39.0
       SYSTEM                            52.0                                720

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    6/76      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE      6/76      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                          LOW RELIABILITY FACTORS FOR THE MONTH OF JUNE RESULTED FROM A SCHEDULED
                          MID-YEAR SCRUBBER SHUTDOWN FOR MAINTENANCE, INSPECTION AND REPAIRS.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    6/76      EQUIPMENT: RECYCLE TANK
            END DATE      6/76      PROBLEM: CHEMICAL-RELATED CORROSION
                          SOME SCALING AND CORROSION PROBLEMS WERE UNCOVERED IN THE SYSTEM'S RECYCLE
                          TANKS.
            AFFECTED MODULES: SYSTEM

 7/76  A                                100.0
       B                                 98.0
       SYSTEM                            99.0                                744

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    7/76      EQUIPMENT: SCRUBBER
            END DATE      8/76      COMMENTS:
                          REPAIRS TO THE COATING IN THE ELBOW OF THE SCRUBBER EXHAUST DUCT WERE COM-
                          PLETED.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    7/76      EQUIPMENT: MIST ELIMINATOR
            END DATE      8/76      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                          A MALFUNCTIONING SOLENOID VALVE IN THE MIST ELIMINATOR WASH SYSTEM OF THE
                          B-SIDE, PREVENTING ADEQUATE WASHING, RESULTED IN A MINOR SCRUBBER OUTAGE.
            AFFECTED MODULES: SYSTEM

 8/76  A                                100.0
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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------------------------------------------PERFORMANCE DATA---------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
       B                                   100.0
       SYSTEM                              100.0                                744

  9/76 A                                   100.0
       B                                   100.0
       SYSTEM                              100.0                                720    720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/76     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     9/76     COMMENTS:
                        THE BOILER REMAINED OUT OF SERVICE THE ENTIRE MONTH. NO SIGNIFICANT PROB-
                        LEMS WERE REPORTED.
            AFFECTED MODULES: SYSTEM

 10/76 A                                    56.0
       B                                    56.0
       SYSTEM                               56.0                                744    417

 11/76 A                                    96.0
       B                                    98.0
       SYSTEM                               97.0                                720    720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/76     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    11/76     COMMENTS:
                        TWO MINOR FORCED SCRUBBER OUTAGES OCCURRED DURING THE PERIOD.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/76     EQUIPMENT: REAGENT HANDLING
            END DATE    11/76     PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                        A REHEATER STEAM LEAK CAUSED A MINOR FORCED OUTAGE.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/76     EQUIPMENT: GAS DAMPER
            END DATE    11/76     PROBLEM: DESIGN-RELATED FLOW DISTRIBUTION
                        AN INLET GAS DAMPER ADJUSTMENT PROBLEM IN BOTH THE A-SIDE AND B-SIDE SCRUB
                        BING TRAINS CAUSED A MINOR OUTAGE.
            AFFECTED MODULES: SYSTEM

 12/76 A                                    98.0
       B                                   100.0
       SYSTEM                               99.0                                744    744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/76     EQUIPMENT: GAS DAMPER
            END DATE    12/76     PROBLEM: DESIGN-RELATED FLOW DISTRIBUTION
                        ONE OUTAGE WAS REPORTED.  THE OUTAGE WAS THE RESULT OF AN ADDITIONAL AD-
                        JUSTMENT TO THE A-SIDE GAS INLET DAMPER.
            AFFECTED MODULES: A

  1/77 A                                    72.0
       B                                    93.0
       SYSTEM                               83.0                                744    744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   0/77     EQUIPMENT:
            END DATE     0/77     COMMENTS:
                        THE PERFORMANCE INDEX VALUES CONTAINED IN THESE TABLES ARE BASED UPON THE
                        MODULES' ACTUAL SERVICE TIME FOR THE PERIOD VERSUS THE NUMBER OF HOURS THE
                        MODULES ARE CALLED UPON TO OPERATE FOR THE SAME PERIOD.  THE MODULES OPER-
                        ATE ON A DEMAND-ONLY BASIS.  FLUE GAS IS BYPASSED AROUND THE MODULES WHEN
                        THEY ARE NOT REQUIRED FOR SERVICE.
            AFFECTED MODULES: SYSTEM

  2/77 A                                    99.0
```

```
---------------------------------------------PERFORMANCE DATA-----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
       B                                   99.0
       SYSTEM                              99.0                                  672   672

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   2/77     EQUIPMENT: ABSORBER
             END DATE     2/77     COMMENTS: RESEARCH AND DEVELOPMENT
                          THE MUNTERS PACKING IN THE A-SIDE TOWER WAS REPLACED.
             AFFECTED MODULES: A

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   2/77     EQUIPMENT: SCRUBBER
             END DATE     2/77     PROBLEM: CHEMICAL-RELATED PLUGGING
                          MINOR SCRUBBER VESSEL PLUGGING OCCURRED.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   2/77     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     2/77     PROBLEM: CHEMICAL-RELATED CORROSION
                          MINOR CORROSION OCCURRED IN THE SYSTEM.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   2/77     EQUIPMENT: PIPING
             END DATE     2/77     PROBLEM: NOT DEFINED/SPECIFIED
                          SOME PROBLEMS OCCURRED WITH THE LIQUID PIPING.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   2/77     EQUIPMENT: GAS DAMPER
             END DATE     2/77     PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                          THERE WERE MECHANICAL DIFFICULTIES WITH THE BY-PASS DAMPERS.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   2/77     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     2/77     COMMENTS:
                          AVERAGE SO2 INLET/OUTLET VALUES DURING THE PERIOD WERE 350 PPM AND 175 PPM
             AFFECTED MODULES: SYSTEM

3/77   A                                   72.0
       B                                   93.0
       SYSTEM                              83.0                                  744   744

4/77   A                                  100.0
       B                                  100.0
       SYSTEM                             100.0                                  720   638

5/77   A                                   87.0
       B                                   87.0
       SYSTEM                              87.0                                  744   645

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   5/77     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     5/77
                          OUTAGE TIME FOR THE BOILER AND FGD SYSTEM WAS A RESULT OF THE SCHEDULED
                          MID-YEAR SCRUBBER CLEANOUT.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   5/77     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     5/77     COMMENTS: RESEARCH AND DEVELOPMENT
                          DURING MAY RESEARCH-COTTRELL PERSONNEL CONDUCTED FORCED OXIDATION TESTS BY
                          BLOWING AIR INTO THE FLOODED DISC SCRUBBER AND CONVERTING ALL CASO3 TO
                          CASO4 TO SUPERIOR SLUDGE DEWATERING. HANDLING AND SCALE-FREE OPERATION.
             AFFECTED MODULES: SYSTEM

6/77   A                                  100.0
```

```
---------------------------------------------PERFORMANCE DATA-------------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------
       B                               100.0
       SYSTEM                          100.0                                 720   720

 7/77  A                                97.0
       B                                99.0
       SYSTEM                           98.0                                 744   744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    7/77      EQUIPMENT: REAGENT HANDLING
             END DATE      7/77      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                           A MINOR LEAK OCCURRED IN THE LIMESTONE SLURRY TANK.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    7/77      EQUIPMENT: SCRUBBER
             END DATE      7/77      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                           A MINOR LEAK OCCURRED IN THE B-SIDE RETURN LINE FROM THE FDS TO THE FDS.
                           TANK.
             AFFECTED MODULES: B

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    7/77      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE      7/77      COMMENTS: RESEARCH AND DEVELOPMENT
                           RESEARCH-COTTRELL PERSONNEL ARE STILL ON THE PLANT SITE, CONTINUING FORCED
                           OXIDATION STUDIES.
             AFFECTED MODULES: SYSTEM

 8/77  A                                97.0
       B                                99.0
       SYSTEM                           98.0                                 744   744

 9/77  A                               100.0
       B                               100.0
       SYSTEM                          100.0                                 720   720

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    9/77      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE      9/77      COMMENTS:
                           DOWN TIME WAS REQUIRED TO REPAIR LEAKS IN THE SLURRY DISPOSAL TANK AND THE
                           FCS RETURN LINE.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    9/77      EQUIPMENT: SCRUBBER
             END DATE      9/77      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                           A LEAK OCCURRED AT THE SLURRY DISPOSAL TANK.
             AFFECTED MODULES: SYSTEM SYSTEM

10/77  A                               100.0
       B                               100.0
       SYSTEM                          100.0                                 744   744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    9/77      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     10/77      COMMENTS:
                           NO PROBLEMS WERE REPORTED FOR OCTOBER.
             AFFECTED MODULES: SYSTEM

11/77  A                               100.0
       B                                98.0
       SYSTEM                           99.0                                 720   169

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   11/77      EQUIPMENT: SCRUBBER
             END DATE     11/77      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                           THE B-SIDE OUTAGE WAS DUE TO LEAKS IN THE VENTURI SECTION OF THE SCRUBBER
                           AND AN EXPANSION JOINT FAILURE IN A RECYCLE PUMP.
```

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---------------------------------------------PERFORMANCE DATA--------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL    PER BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
              AFFECTED MODULES: B

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  11/77      EQUIPMENT: RECYCLE PUMP
              END DATE    11/77      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                           THE B-SIDE OUTAGE WAS DUE TO LEAKS IN THE VENTURI SECTION OF THE SCRUBBER
                           AND AN EXPANSION JOINT FAILURE IN A RECYCLE PUMP.
              AFFECTED MODULES: B

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  11/77      EQUIPMENT: BOILER-RELATED
              END DATE    11/77      COMMENTS:
                            HTE BOILER OPERATED ONLY 168.5 HOURS BECAUSE OF A SHUTDOWN FOR OVERHAUL IN
                            THE LAST HALF OF NOVEMBER.  THE UNIT IS SCHEDULED TO START UP IN MID-DEC-
                            EMBER.
              AFFECTED MODULES: SYSTEM

12/77  SYSTEM                                                               744

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  12/77      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE    12/77      COMMENTS:
                            THE BOILER AND SCRUBBING SYSTEM WERE DOWN AS THE OVERHAUL PERIOD CONTINUED
                            THIS MOJOR OVERHAUL CONTINUED INTO JANUARY 1978.
              AFFECTED MODULES; SYSTEM

 1/78  A                                   97.0
       B                                   91.0
       SYSTEM                              94.0                60.00 99.70  744   135

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   1/78      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     1/78      COMMENTS:
                            THE FLOODED DISC SCRUBBER TANK HEADER FOR THE LIMESTONE SLURRY WAS REPAIR-
                            ED AFTER BEING DAMAGED DURING THE OVERHAUL.  THE BOILER WAS OPERATED ONLY
                            135 HOURS DURING JANUARY AS THE OVERHAUL HAD EXTENDED INTO THIS MONTH.
              AFFECTED MODULES: SYSTEM

 2/78  A                                   99.0
       B                                   88.0
       SYSTEM                              94.0                50.00        672   642

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   2/78      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     2/78      PROBLEM: NOT DEFINED/SPECIFIED
                            SOME MINOR LEAK REPAIRS AFTER THE OVERHAUL/CLEANING TOOK PLACE DURING
                            FEBRUARY.
              AFFECTED MODULES: SYSTEM

 3/78  A                                   74.0
       B                                   74.0
       SYSTEM                              74.0                             744   744

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   3/78      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     3/78      PROBLEM: NOT DEFINED/SPECIFIED
                            ONE FORCED SHUTDOWN OCCURRED ON THE A-SIDE.
              AFFECTED MODULES: A

 4/78  A                                  100.0
       B                                  100.0
       SYSTEM                             100.0                             720   720

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   4/78      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     4/78      PROBLEM: NOT DEFINED/SPECIFIED
                            A MINOR LEAK REPAIR WAS NECESSARY AFTER AN OVERHAUL/CLEANING.
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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-------------------------------------------PERFORMANCE DATA----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
             AFFECTED MODULES: SYSTEM

 5/78  A                                  87.0
       B                                  98.0
       SYSTEM                             93.0                               744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   5/78      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     5/78      COMMENTS:
                         THERE WERE NO SIGNIFICANT PROBLEMS REPORTED.  ONLY GENERAL MAINTENANCE WAS
                         PERFORMED ON THE SYSTEM.
             AFFECTED MODULES: SYSTEM

 6/78  A                                 100.0
       B                                 100.0
       SYSTEM                            100.0                               720

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   6/78      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     6/78      COMMENTS:
                         NO PROBLEMS WERE REPORTED.
             AFFECTED MODULES: SYSTEM

 7/78  B                                 100.0
       SYSTEM                            100.0                               744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   7/78      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     7/78      COMMENTS:
                         ONLY ROUTINE MAINTENANCE WAS REQUIRED.
             AFFECTED MODULES: SYSTEM

 8/78  SYSTEM                             98.0                               744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   8/78      EQUIPMENT: RECYCLE TANK
             END DATE     8/78      PROBLEM: NOT DEFINED/SPECIFIED
                         REPAIRS WERE NECESSARY TO PLUGGED B-SIDE REHEAT COILS.
             AFFECTED MODULES: B

 9/78  B                                 100.0
       SYSTEM                            100.0                               720   720

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   9/78      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     9/78      COMMENTS:
                         NO PROBLEMS WERE REPORTED.
             AFFECTED MODULES: SYSTEM

10/78  B                                 100.0
       SYSTEM                            100.0                               744   434

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/78      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    10/78      COMMENTS:
                         ONLY ROUTINE MAINTENANCE WAS REQUIRED.
             AFFECTED MODULES: SYSTEM

11/78  SYSTEM                            100.0                               720   720

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  11/78      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    11/78      COMMENTS:
                         NO PROBLEMS WERE REPORTED.
             AFFECTED MODULES: SYSTEM
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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COMPANY NAME                                       ARIZONA PUBLIC SERVICE
PLANT NAME                                         CHOLLA
UNIT NUMBER                                        2
CITY                                               JOSEPH CITY
STATE                                              ARIZONA
REGULATORY CLASSIFICATION                          B
PARTICULATE EMISSION LIMITATION - NG/J               72.        (  .167 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                      344.        (  .800 LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW                  615.0
GROSS UNIT GENERATING CAPACITY - MW                 350.0
NET UNIT GENERATING CAPACITY W/FGD - MW             250.0
NET UNIT GENERATING CAPACITY WO/FGD - MW           *******
EQUIVALENT SCRUBBED CAPACITY - MW                   350.0

** BOILER DATA
   SUPPLIER                                        COMBUSTION ENGINEERING
   TYPE                                            PULVERIZED COAL
   SERVICE LOAD                                    BASE
   COMMERCIAL SERVICE DATE                          0/78
   MAXIMUM BOILER FLUE GAS FLOW - CU.M/S           ********     (******* ACFM)
   FLUE GAS TEMPERATURE - C                        *******      (**** F)
   STACK HEIGHT - M                                ******       (**** FT)
   STACK TOP DIAMETER - M                          *******      (***** FT)

** FUEL DATA
   FUEL TYPE                                       COAL
   FUEL GRADE                                      SUBBITUMINOUS
   AVERAGE HEAT CONTENT - KJ/KG                     23609.      ( 10150 BTU/LB)
   RANGE HEAT CONTENT - BTU/LB                                   965-10,600
   AVERAGE ASH CONTENT - %                             13.50
   RANGE ASH CONTENT - %                           9.7-22.5
   AVERAGE MOISTURE CONTENT - %                        15.00
   RANGE MOISTURE CONTENT - %                      ******
   AVERAGE SULFUR CONTENT - %                            .50
   RANGE SULFUR CONTENT - %                        0.44-1.0
   AVERAGE CHLORIDE CONTENT - %                          .02
   RANGE CHLORIDE CONTENT - %                      0.01-0.04
   FUEL FIRING RATE - M T/H                        *******      (*** TPH)
   FUEL FIRING RATE - MW                           *****

** MECHANICAL COLLECTOR
   PARTICULATE DESIGN REMOVAL EFFICIENCY - %          75.0

** FGD SYSTEM
   SALEABLE PRODUCT/THROWAWAY PRODUCT              THROWAWAY PRODUCT
   GENERAL PROCESS TYPE                            WET SCRUBBING
   PROCESS TYPE                                    LIMESTONE
   SYSTEM SUPPLIER                                 RESEARCH COTTRELL
   A-E FIRM                                        EBASCO
   DEVELOPMENT LEVEL                               FULL-SCALE
   NEW/RETROFIT                                    NEW
   PARTICULATE DESIGN REMOVAL EFFICIENCY - %          99.70
   SO2 DESIGN REMOVAL EFFICIENCY - %                  75.00
   INITIAL START-UP                                 4/78
   CONSTRUCTION INITIATION                          7/75
   CONTRACT AWARDED                                12/74

** ABSORBER
   NUMBER                                          4
   TYPE                                            PACKED TOWER PRECEEDED BY FLOODED DISC SCRUBBER
   INITIAL START UP                                 6/78
   BOILER LOAD/ABSORBER - %                           25.0
   GAS FLOW - CU.M/S                                 184.98      ( 392000 ACFM)
   GAS TEMPERATURE - C                                50.0       (  122 F)

** REHEATER
   TYPE                                            IN-LINE
   HEATING MEDIUM                                  STEAM
   TEMPERATURE BOOST - C                              22.2       (   40 F)

** WATER LOOP
   TYPE                                            OPEN
   FRESH MAKEUP WATER ADDITION - LITERS/S              7.6       (  120 GPM)
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** REAGENT PREPARATION EQUIPMENT
    NUMBER OF BALL MILLS                            2
    BALL MILL CAPACITY- M T/H                       6.3          ( 7.0 TPH)

** DISPOSAL
    NATURE                                          FINAL
    TYPE                                            SLUDGE POND


-------------------------------------------PERFORMANCE DATA-------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

 4/78  SYSTEM                                                               720

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    4/78     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE      5/78     PROBLEM: NOT DEFINED/SPECIFIED
                           SOME PROBLEMS HAVE OCCURRED WITH VIBRATIONS THROUGH THE SYSTEM.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    4/78     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE      5/78     COMMENTS:
                           THE EPA HAS GRANTED THE UTILITY AN EXTENSION FOR COMPLIANCE.
             AFFECTED MODULES: SYSTEM

 5/78  SYSTEM                                                               744

 6/78  SYSTEM                                                               720

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    6/78     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE      7/78     COMMENTS:
                           SHAKEDOWN/DEBUGGING OPERATIONS ARE CONTINUING.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    6/78     EQUIPMENT: PIPING
             END DATE      7/78     PROBLEM: DESIGN-RELATED VIBRATION
                           THE SLURRY RECYCLE PIPING HAS EXPERIENCED CONTINUAL VIBRATION.  THE CON-
                           TRACTOR HAS BEEN INJECTING NITROGEN GAS INTO THE LINES TO DAMPEN THE
                           VIBRATIONS(AIR WAS NOT USED BECAUSE THE SULFITE WOULD BE OXIDIZED TO SUL-
                           FATE AND RESULT IN SCALE FORMATION).
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    6/78     EQUIPMENT: ABSORBER
             END DATE      7/78     PROBLEM: INSTALLATION-RELATED MATERIALS FAILURE
                           THE CORROSION RESISTANT COATING IN THE DOWNCOMER AREA IN ONE OF THE
                           ABSORBER MODULES HAS BEEN PEELING AWAY.
             AFFECTED MODULES: SYSTEM

 7/78  SYSTEM                                                               744

 8/78  SYSTEM                                                               744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    8/78     EQUIPMENT: PIPING
             END DATE      9/78     PROBLEM: DESIGN-RELATED VIBRATION
                           THE SLURRY COMPONENTS ARE STILL EXPERIENCING RESONANT VIBRATIONS.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    8/78     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE      9/78     COMMENTS:
                           SHAKEDOWN/DEBUGGING OPERATIONS ARE CONTINUING.
             AFFECTED MODULES: SYSTEM

 9/78  SYSTEM                                                               720

10/78  SYSTEM                                                               744
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------------------------------------------PERFORMANCE DATA----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/78     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    11/78     COMMENTS:
                                   SHAKEDOWN DEBUGGING OPERATIONS ARE CONTINUING.  SOME SCRUBBER COMPONENTS
                                   ARE STILL MANNED BY BECHTEL STAFF, APS IS OPERATING MOST OF THE SYSTEM AT
                                   THIS TIME.
             AFFECTED MODULES: SYSTEM

11/78  SYSTEM                                                                  720
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                                    SECTION 3
                DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
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 COMPANY NAME                               CENTRAL ILLINOIS LIGHT
 PLANT NAME                                 DUCK CREEK
 UNIT NUMBER                                1
 CITY                                       CANTON
 STATE                                      ILLINOIS
 REGULATORY CLASSIFICATION                  A
 PARTICULATE EMISSION LIMITATION - NG/J       43.         (  .100 LB/MMBTU)
 SO2 EMISSION LIMITATION - NG/J              516.         ( 1.200 LB/MMBTU)
 NET PLANT GENERATING CAPACITY - MW          400.0
 GROSS UNIT GENERATING CAPACITY - MW         416.0
 NET UNIT GENERATING CAPACITY W/FGD - MW     400.0
 NET UNIT GENERATING CAPACITY WO/FGD - MW   *******
 EQUIVALENT SCRUBBED CAPACITY - MW           416.0

 ** BOILER DATA
     SUPPLIER                               RILEY STOKER
     TYPE                                   BALANCED-DRAFT, FRONT FIRED DRYBOTTOM, PULV. COA
     SERVICE LOAD                           BASE
     COMMERCIAL SERVICE DATE                 0/76
     MAXIMUM BOILER FLUE GAS FLOW - CU.M/S    667.74      (1415000 ACFM)
     FLUE GAS TEMPERATURE - C                 135.0       ( 275 F)
     STACK HEIGHT - M                         152.        ( 500 FT)
     STACK TOP DIAMETER - M                 *******       (***** FT)

 ** FUEL DATA
     FUEL TYPE                              COAL
     FUEL GRADE                             BITUMINOUS
     AVERAGE HEAT CONTENT - KJ/KG            24423.       ( 10500 BTU/LB)
     RANGE HEAT CONTENT - BTU/LB                           ******
     AVERAGE ASH CONTENT - %                    9.12
     RANGE ASH CONTENT - %                  18.0
     AVERAGE MOISTURE CONTENT - %           ********
     RANGE MOISTURE CONTENT - %             ******
     AVERAGE SULFUR CONTENT - %                 3.30
     RANGE SULFUR CONTENT - %               8.0-9.0
     AVERAGE CHLORIDE CONTENT - %                .03
     RANGE CHLORIDE CONTENT - %             ******
     FUEL FIRING RATE - M T/H                157.8        (174 TPH)
     FUEL FIRING RATE - MW                   400

 ** ESP
     NUMBER                                  2
     TYPE                                   COLD SIDE
     SUPPLIER                               POLLUTION CONTROL-WALTHER
     PARTICULATE DESIGN REMOVAL EFFICIENCY - %   99.8
     FLUE GAS TEMPERATURE - C                135.0        (  275 F)
     PRESSURE DROP - KPA                        .2        (    1 IN-H2O)

 ** FGD SYSTEM
     SALEABLE PRODUCT/THROWAWAY PRODUCT     SALEABLE PRODUCT
     GENERAL PROCESS TYPE                   WET SCRUBBING
     PROCESS TYPE                           LIMESTONE
     SYSTEM SUPPLIER                        RILEY STOKER/ENVIRONEERING
     A-E FIRM                               GILBERT/COMMONWEALTH
     DEVELOPMENT LEVEL                      FULL-SCALE
     NEW/RETROFIT                           NEW
     PARTICULATE DESIGN REMOVAL EFFICIENCY - %   99.80
     SO2 DESIGN REMOVAL EFFICIENCY - %        85.00
     COMMERCIAL DATE                         8/78
     INITIAL START-UP                        7/76
     CONTRACT AWARDED                        8/76

 ** ABSORBER
     NUMBER                                  4
     TYPE                                   ROD DECK SPRAY TOWER
     INITIAL START UP                        7/76
     NUMBER OF STAGES                          0
     DIMENSIONS                             40 X 5 X 40
     SHELL MATERIAL                         CARBON STEEL
     INTERNAL MATERIAL                      HASTALLOY G
     NUMBER OF NOZZLES                        12
     NOZZLE TYPE                            OPEN PIPE ARRANGEMENT
     BOILER LOAD/ABSORBER - %                 25.0
     GAS FLOW - CU.M/S                       167.01       ( 353900 ACFM)
     GAS TEMPERATURE - C                     135.0        (  275 F)
     LIQUID RECIRCULATION RATE - LITER/S     945.         (15000 GPM)
```

```
-----------------------------------------------------------------------------------------------------------
        PRESSURE DROP - KPA                               2.0          ( 8.0 IN-H2O)
        SUPERFICAL GAS VELOCITY - M/SEC                   4.0          ( 13.0 FT/S)
        SO2 INLET CONCENTRATION - PPM                  3000
        SO2 OUTLET CONTRATION - PPM                     252

   ** FANS
        NUMBER                                          4
        TYPE                                          BOILER I.D.
        CONSTRUCTION MATERIALS                        CARBON STEEL

   ** MIST ELIMINATOR
        NUMBER                                          4
        TYPE                                          CHEVRON
        CONSTRUCTION MATERIAL                         HASTALLOY G
        CONFIGURATION                                 HORIZONTAL
        NUMBER OF STAGES                                  2
        NUMBER OF PASSES                                  3
        VANE SPACING - CM                                 6.3          ( 2.50 IN)
        VANE ANGLES                                   90 DEG.
        WASH SYSTEM                                   CONTINUOUS, BW PRESSURE, FRONT AND BACK OF FIRST
        SUPERFICIAL GAS VELOCITY - M/S                    4.0          ( 13.0 FT/S)
        PRESSURE DROP - KPA                                .2          ( 1.0 IN-H2O)

   ** PROCESS CONTROL CHEMISTRY
        CONTROL VARIABLES                             SO2, PH, SOLIDS CONTENT OF SLURRY
        CONTROL MANNER                                AUTOMATIC
        MODE                                          FEEDBACK AND FEED FORWARD

   ** PUMPS
        SERVICE                                       NUMBER
        -------                                       ------
        POND RETURN                                       1
        ROND RETURN (SPARE)                               1
        WASTE TRANSFER                                    1
        WASTE TRANSFER (SPARE)                            1
        MIST ELIMINATOR SPRAY                             8
        MIST ELEIMATOR SPARY                              4
        RECIRCULATION                                     8
        RECIRCULATION (SPARE)                             4
        SLURRY TRANSFER                                   1
        SLURRY TRANSFER (SPARE)                           3

   ** TANKS
        SERVICE                                       NUMBER
        -------                                       ------
        RECIRCULATION                                     4
        WASTE COLLECTION                                  1
        LIMESTONE SLURRY STORAGE                          1
        LIMESTONE SLURRY STORAGE (SPARE)                  3
        MIST ELIMINATOR WASH                          ****

   ** WATER LOOP
        TYPE                                          CLOSED
        FRESH MAKEUP WATER ADDITION - LITERS/S           37.8          (  600 GPM)

   ** REAGENT PREPARATION EQUIPMENT
        NUMBER OF BALL MILLS                              1
        BALL MILL CAPACITY- M T/H                         3.6          ( 4.0 TPH)

   ** DISPOSAL
        NATURE                                        FINAL
        TYPE                                          LINED POND
        LOCATION                                      ON SITE
        TRANSPORTATION                                PUMP
        AREA - ACRES                                     65.0
        CAPACITY - CU.M                                  317980        (   260.0 ACRE-FT)
```

```
------------------------------------------PERFORMANCE DATA-----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------

 6/78  SYSTEM                                                   91.60 99.80  720     0           .0

 7/78  SYSTEM                                                                720     0           .0

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    7/78      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE      7/78      COMMENTS:
                      ALL FOUR MODULES BECAME OPERATIONAL ON JULY 24.
           AFFECTED MODULES: SYS

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    7/78      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE      7/78      PROBLEM: DESIGN-RELATED UNDERSIZED COMPONENT
                      MODIFICATIONS WERE MADE TO THE UNDER DESIGNED SLURRY TRANSFER TANK.
           AFFECTED MODULES: SYS

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    7/78      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE      9/78      PROBLEM: NOT DEFINED/SPECIFIED
                      A PLUGGING PROBLEM CAUSED BY COAL FINES IN THE SLURRY WAS EXPERIENCED.
                      THE FINES RESULTED FROM COMMON COAL AND LIMESTONE HANDLING SYSTEM.
           AFFECTED MODULES: SYS

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    7/78      EQUIPMENT: REAGENT HANDLING
           END DATE      9/78      PROBLEM: NOT DEFINED/SPECIFIED
                      THE COMMON COAL AND LIMESTONE HANDLING SYSTEM ALLOWED COAL FINES TO PLUG
                      THE FGD SYSTEM.
           AFFECTED MODULES: SYS

 8/78  SYSTEM                                                                744   691           .0

 9/78  SYSTEM                                                                720   691           .0

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    9/78      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE      9/78      PROBLEM: NOT DEFINED/SPECIFIED
                      SCREEN BASKETS WERE USED TO KEEP COAL PARTICLES FROM THE LIMESTONE.  THE
                      COAL PARTICLES RESULT FROM COMMON HANDLING SYSTEM.
           AFFECTED MODULES: SYS

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    9/78      EQUIPMENT: REAGENT HANDLING
           END DATE      9/78      PROBLEM: DESIGN-RELATED UNDERSIZED COMPONENT
                      THE SLURRY TRANSFER SYSTEM PREVENTED PROPER SLURRY FLOW DUE TO UNDER
                      DESIGN.  THE OLD SYSTEM WAS REPLACED WITH A NEW PIPING SYSTEM.
           AFFECTED MODULES: SYS

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    9/78      EQUIPMENT: VALVES
           END DATE      9/78      PROBLEM: CHEMICAL-RELATED PLUGGING
                      PLUGGING OF THE RECYCLE PUMP SHUT-OFF VALVES OCCURED.  THE VALVES ARE
                      BEING REPLACED WITH PINCH VALVES.
           AFFECTED MODULES: SYS

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    9/78      EQUIPMENT: PUMP, OTHER
           END DATE      9/78      PROBLEM: CHEMICAL-RELATED PLUGGING
                      THE SCRUBBER WASTE WATER SUMP PUMPS HAVE BEEN PLUGGING.  NEW PUMPS ARE
                      BEING INVESTIGATED.
           AFFECTED MODULES: SYS

10/78  SYSTEM                                                                744   449           .0

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   10/78      EQUIPMENT: VALVES
           END DATE     10/78      PROBLEM: NOT DEFINED/SPECIFIED
```

```
------------------------------------------PERFORMANCE DATA--------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                           A LEAKING VALVE RESULTED IN CONTAMINATION OF THE RECYCLE PUMP GLAND SEAL
                           WATER SYSTEM WITH POND RETURN WATER CAUSING SCALING AND PLUGGING FORCING
                           SHUTDOWN OF THE RECYCLE PUMPS.  A NEW VALVE SYSTEM WAS INSTALLED AND THE
                           OPERATING PRESSURES WERE CHANGED.
             AFFECTED MODULES: SYS

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/78      EQUIPMENT: RECYCLE PUMP
             END DATE    10/78      PROBLEM: NOT DEFINED/SPECIFIED
                           THE RECYCLE PUMPS WERE SHUT DOWN WHEN CONTAMINATION OF THE GLAND SEAL
                           WATER SYSTEM CAUSED BY A FAULTY VALVE  CURRED.
             AFFECTED MODULES: SYS

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/78      EQUIPMENT: VALVES
             END DATE    10/78      PROBLEM: NOT DEFINED/SPECIFIED
                           A FLOW CONTROL VALVE WAS REMOVED BECAUSE IT CAUSED ABRASION AND FAILURE
                           OF THE RECYCLE HEADER.  NONE OF THE MODULES NOW UTILIZE FLOW CONTROL
                           VALVES.
             AFFECTED MODULES: D

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/78      EQUIPMENT: MIST ELIMINATOR
             END DATE    10/78      PROBLEM: NOT DEFINED/SPECIFIED
                           THE MIST ELIMINATOR SPRAY NOZZLES PLUGGED BY COAL PARTICLES WERE CLEANED
                           THE COAL PARTICLES RESULT FROM A COMMON COAL/LIMESTONE HANDLING SYSTEM.
                           A LIQUID/SOLID SEPARATOR HAS BEEN INSTALLED IN THE SLURRY SYSTEM TO PRE-
                           VENT REOCCURRENCE.
             AFFECTED MODULES: SYS

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/78      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    10/78      PROBLEM: NOT DEFINED/SPECIFIED
                           EXCESSIVE LIMESTONE CARRYOVER TO THE MIST ELIMINATOR WAS NOTED.  THE TOP
                           ROD DECK WAS REMOVED TO IMPROVE GAS FLOW AND ELIMINATE THE CARRYOVER
                           PROBLEM.
             AFFECTED MODULES: SYS

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/78      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    11/78      PROBLEM: DESIGN-RELATED FLOW DISTRIBUTION
                           BLANK OFF PLATES WERE ADDED TO THE LOWER SEVEN ROD DECKS TO MAINTAIN
                           PRESSURE DROP REQUIREMENTS.  THIS HAS BEEN FOUND TO BE AN ACCEPTABLE
                           SOLUTION AT OTHER ENVIRONEERING SYSTEM INSTALLATIONS.
             AFFECTED MODULES: SYS

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/78      EQUIPMENT: REAGENT HANDLING
             END DATE    10/78      PROBLEM: NOT DEFINED/SPECIFIED
                           THE COMMON COAL/LIMESTONE HANDLING SYSTEM ALLOWED COAL PARTICLES TO PLUG
                           MIST ELIMINATOR SPRAY NOZZLES.  A LIQUID/SOLID SEPARATOR HAS BEEN INSTAL-
                           LED TO PREVENT FUTURE PLUGGING.
             AFFECTED MODULES: SYS

11/78  SYSTEM                                                         720   661              .C

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  11/78      EQUIPMENT: PUMP, OTHER
             END DATE    11/78      PROBLEM: MECHANICAL-RELATED MATERIALS FAILURE
                           THE B-MODULE SLURRY TANK PUMP LINER EXPERIENCED A FAILURE RESULTING IN
                           SCRUBBER SYSTEM SHUTDOWN.  THE SPARE PUMP WAS ALREADY OUT OF SERVICE TO
                           REPLACE ITS ORIGINAL 50-HP MOTOR WITH A 75-HP MOTOR.
             AFFECTED MODULES: B

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  11/78      EQUIPMENT: PUMP, OTHER
             END DATE    11/78      PROBLEM: DESIGN-RELATED UNDERSIZED COMPONENT
BAD C3471    0
```

```
------------------------------------------------PERFORMANCE DATA------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                               SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
                     A SPARE SLURRY TANK PUMP WAS OUT OF SERVICE TO REPLACE ITS ORIGINAL 50-HP
           AFFECTED MODULES: B

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   11/78      EQUIPMENT: REAGENT HANDLING
           END DATE     11/78      PROBLEM: MECHANICAL-RELATED MATERIALS FAILURE
                     THE PINION BEARING ON THE BALL MILL DRIVE FAILED.  THE FAILURE IS BEING
                     INVESTIGATED.  FGD SYSTE OPERATION WAS HALTED DUE TO THE FAILURE-
           AFFECTED MODULES: SYS

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   11/78      EQUIPMENT: INSTRUMENTATION
           END DATE     11/78      PROBLEM: NOT DEFINED/SPECIFIED
                     THE LEVEL AND DENSITY INSTRUMENTS ON RECYCLE TANKS ARE BEING MODIFIED.
           AFFECTED MODULES: SYS

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   11/78      EQUIPMENT: INSTRUMENTATION
           END DATE     11/78      PROBLEM: NOT DEFINED/SPECIFIED
                     THE LEEDS & NORTHRUP LEVEL AND DENSITY TRANSMITTERS ARE BEING REPLACED
                     WITH ROSEMOUNT TRANSMITTERS.
           AFFECTED MODULES: SYS
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

```
COMPANY NAME                                   COLUMBUS & SOUTHERN OHIO ELEC.
PLANT NAME                                     CONESVILLE
UNIT NUMBER                                    5
CITY                                           CONESVILLE
STATE                                          OHIO
REGULATORY CLASSIFICATION                      B
PARTICULATE EMISSION LIMITATION - NG/J         ******         (****** LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                   430.         ( 1.000 LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW              2100.0
GROSS UNIT GENERATING CAPACITY - MW              411.0
NET UNIT GENERATING CAPACITY W/FGD - MW          375.0
NET UNIT GENERATING CAPACITY WO/FGD - MW         391.0
EQUIVALENT SCRUBBED CAPACITY - MW                411.0

** BOILER DATA
     SUPPLIER                                  COMBUSTION ENGINEERING
     TYPE                                      PULVERIZED COAL, DRY BOTTOM
     SERVICE LOAD                              BASE
     COMMERCIAL SERVICE DATE                    0/77
     MAXIMUM BOILER FLUE GAS FLOW - CU.M/S     ********       (******* ACFM)
     FLUE GAS TEMPERATURE - C                    146.7        ( 296 F)
     STACK HEIGHT - M                            244.         ( 800 FT)
     STACK TOP DIAMETER - M                    *******        (***** FT)

** FUEL DATA
     FUEL TYPE                                 COAL
     FUEL GRADE                                BITUMINOUS
     AVERAGE HEAT CONTENT - KJ/KG               25237.        ( 10850 BTU/LB)
     RANGE HEAT CONTENT - BTU/LB                               10300-11220
     AVERAGE ASH CONTENT - %                       15.10
     RANGE ASH CONTENT - %                     12-19
     AVERAGE MOISTURE CONTENT - %                   7.50
     RANGE MOISTURE CONTENT - %                ******
     AVERAGE SULFUR CONTENT - %                     4.67
     RANGE SULFUR CONTENT - %                  4.2-5.1
     AVERAGE CHLORIDE CONTENT - %              ********
     RANGE CHLORIDE CONTENT - %                ******
     FUEL FIRING RATE - M T/H                    149.7        (165 TPH)
     FUEL FIRING RATE - MW                     *****

** ESP
     NUMBER                                     1
     TYPE                                      COLD SIDE
     SUPPLIER                                  RESEARCH COTTRELL

** FGD SYSTEM
     SALEABLE PRODUCT/THROWAWAY PRODUCT        THROWAWAY PRODUCT
     GENERAL PROCESS TYPE                      WET SCRUBBING
     PROCESS TYPE                              LIME
     PROCESS ADDITIVES                         THIOSORBIC
     SYSTEM SUPPLIER                           AIR CORRECTION DIVISION, UOP
     A-E FIRM                                  BLACK & VEACH
     DEVELOPMENT LEVEL                         FULL SCALE
     NEW/RETROFIT                              NEW
     PARTICULATE DESIGN REMOVAL EFFICIENCY - %    99.60
     SO2 DESIGN REMOVAL EFFICIENCY - %            89.50
     COMMERCIAL DATE                            2/77
     INITIAL START-UP                           1/77
     CONSTRUCTION INITIATION                    5/75
     CONTRACT AWARDED                          10/74

** ABSORBER
     NUMBER                                     1
     TYPE                                      TURBULENT CONTACT ABSORBER
     INITIAL START UP                          11/77
     SUPPLIER                                  AIR CORRECTION DIVISION,UOP
     NUMBER OF STAGES                             4
     SHELL MATERIAL                            CARBON STEEL
     SHELL LINER MATERIAL                      NEOPRENE
     BOILER LOAD/ABSORBER - %                     60.0
     GAS FLOW - CU.M/S                           298.44       ( 632416 ACFM)
     GAS TEMPERATURE - C                         141.1        (  286 F)
     LIQUID RECIRCULATION RATE - LITER/S        2394.         (38000 GPM)
     PRESSURE DROP - KPA                            1.8       ( 7.3 IN-H2O)
     SUPERFICAL GAS VELOCITY - M/SEC                3.9       ( 12.8 FT/S)
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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------------------------------------------------------------------------------------------

** ABSORBER
     NUMBER                                      1
     TYPE                                        TURBULENT CONTACT ABSORBER
     INITIAL START UP                             1/77
     SUPPLIER                                    AIR CORRECTION DIVISION,UOP
     NUMBER OF STAGES                               4
     SHELL MATERIAL                              CARBON STEEL
     SHELL LINER MATERIAL                        NEOPRENE
     BOILER LOAD/ABSORBER - %                       60.0
     GAS FLOW - CU.M/S                             298.44        ( 632416 ACFM)
     GAS TEMPERATURE - C                           141.1         (  286 F)
     LIQUID RECIRCULATION RATE - LITER/S          2394.          (38000 GPM)
     PRESSURE DROP - KPA                             1.8         ( 7.3 IN-H2O)
     SUPERFICAL GAS VELOCITY - M/SEC                 3.9         ( 12.8 FT/S)

** FANS
     NUMBER                                      1

** VACUUM FILTER
     NUMBER                                      1

** MIST ELIMINATOR
     NUMBER                                      4
     TYPE                                        CHEVRON
     CONFIGURATION                               HORIZONTAL

** MIST ELIMINATOR
     NUMBER                                      2
     TYPE                                        ENTRAINMENT SEPARATOR

** PUMPS
     SERVICE                                     NUMBER
     -------                                     ------
     RECYCLE                                       5
     TRANSFER TANK PUMP                            1
     MAKE-UP SLURRY PUMP                           1
     RECYCLE TANK SLUDGE PUMP                      2
     M.E. WASH TANK PUMP                           2
     RECLAIMED WATER PUMP                          1

** TANKS
     SERVICE                                     NUMBER
     -------                                     ------
     RECYCLE                                       1
     RECLAIMED WATER TANK                          1
     SLURRY TRANSFER TANK                          1
     SLURRY STORAGE                                1
     M.E. WASH TANK                                1

** THICKENER
     CONSTRUCTION MATERIAL                       CARBON STEEL WITH CONCRETE FLOOR
     DIAMETER - M                                   44.2         (145 FT)
     OUTLET SOLIDS - %                              32.5

** WATER LOOP
     TYPE                                        OPEN
     FRESH MAKEUP WATER ADDITION - LITERS/S         31.5         (  500 GPM)

** TREATMENT
     TYPE                                        PROPRIETARY (POZ-O-TEC)
     CONTRACTOR                                  IUCS
     PRODUCT CHARACTERISTICS                     73% SOLIDS

** DISPOSAL
     NATURE                                      FINAL
     TYPE                                        LANDFILL
     LOCATION                                    ON-SITE
     TRANSPORTATION                              PIPE
     AREA - ACRES                                   50.0
```

```
-----------------------------------PERFORMANCE DATA------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER BOILER  FGD   CAP.
                                                               SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------

12/76  SYSTEM                                                               744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/76     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    12/76     PROBLEM: NOT DEFINED/SPECIFIED
                       A MAJOR FIRE IN MODULE A DELAYED THE UNIT START-UP.  THE FIRE CAUSED $2.1
                       MILLION DAMAGE.  THE UTILITY'S INSURANCE COVERED THE DAMAGE AND A NEW
                       SCRUBBER MODULE WILL BE PURCHASED FROM AND INSTALLED BY UOP.
            AFFECTED MODULES: A

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/76     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    12/76     COMMENTS:
                       THE UTILITY IS CURRENTLY CONDUCTING AIR AND WATER TESTS ON MODULE B.
            AFFECTED MODULES: B

  1/77 SYSTEM                                                               744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/77     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     1/77     COMMENTS:
                       INITIAL START-UP FOR DEBUGGING AND COMMISSIONING PURPOSES OCCURRED IN
                       EARLY JANUARY.  COMMERCIAL AVAILABILITY FOR SERVICE OCURRED ON JANUARY
                       27.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/77     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     1/77     PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                       EARLY OPERATIONS WERE MARKED BY COLD WEATHER RELATED PROBLEMS SUCH AS
                       FROZEN LINES AND GEARS, CRACKED FLANGES, A FROZEN LIME BELT CONVEYOR, AND
                       A FROZEN PIPELINE FROM THE THICKENER TO THE IUCS FACILITY.
            AFFECTED MODULES: SYSTEM

  2/77 B                          43.0                    43.0
       A
       SYSTEM                                                               672   668

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   2/77     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     2/77     COMMENTS:
                       COMMERCIAL START-UP OF MODULE B OCCURRED ON FEBRUARY 13, 1977.  THE LONG-
                       EST PERIOD OF CONTINUOUS OPERATION WAS 132 HOURS.
            AFFECTED MODULES: B

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   2/77     EQUIPMENT: ESP
            END DATE     2/77     COMMENTS:
                       THE UTILITY REPORTED THAT THE ESP OPERATED SATISFACTORILY.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   2/77     EQUIPMENT: PIPING
            END DATE     2/77     PROBLEM: DESIGN-RELATED PRESSURE SURGES
                       PRESSURE SURGES OCCURRED IN THE PRESATURATOR PIPING.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   2/77     EQUIPMENT: GAS ANALYZER
            END DATE     2/77     PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                       THE CONTINUOUS SO2 ANALYZERS OPERATED UNSATISFACTORILY.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   2/77     EQUIPMENT: ABSORBER
            END DATE     2/77     PROBLEM: DESIGN-RELATED FLOW DISTRIBUTION
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-------------------------------------------PERFORMANCE DATA------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION % REMOVAL    PER  BOILER FGD    CAP.
                                                               SO2   PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
                          MODULE B EXPERIENCED POOR VELOCITY DISTRIBUTION THROUGH THE TCA BEDS.
             AFFECTED MODULES: B

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   2/77      EQUIPMENT: MIST ELIMINATOR
             END DATE     2/77      PROBLEM: NOT DEFINED/SPECIFIED
                          SCRUBBING LIQUOR WAS CARRYING OVER INTO THE MIST ELIMINATOR SECTION
             AFFECTED MODULES: B

3/77   SYSTEM
                                                                            744

4/77   A
       B         40.0         38.0        39.0        36.0
       SYSTEM
                                                                            720   685

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   4/77      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     5/77      COMMENTS:
                          A STACK OUTLET TEMPERATURE OF 200 F IS BEING MAINTAINED IN ORDER TO MIN-
                          IMIZE ACID RAINOUT AND STACK CORROSION PROBLEMS.
             AFFECTED MODULES: B

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   4/77      EQUIPMENT: ABSORBER
             END DATE     5/77      PROBLEM: CHEMICAL-RELATED CORROSION
                          THE 316 SS PRESATURATOR AREA HAS EXPERIENCED CORROSION.
             AFFECTED MODULES: B

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   4/77      EQUIPMENT: RECYCLE TANK
             END DATE     5/77      PROBLEM: INSTALLATION-RELATED MATERIALS FAILURE
                          THE RUBBER LINER IN THE RECYCLE TANK HAS BEEN PEELING AWAY.  THE PROBLEM
                          APPEARED TO BE APPLICATION-RELATED.
             AFFECTED MODULES: B

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   4/77      EQUIPMENT: THICKENER
             END DATE     5/77      PROBLEM: CHEMICAL-RELATED PLUGGING
                          SOME PLUGGING HAS OCCURRED IN THE TUBE THICKENERS.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   4/77      EQUIPMENT: REAGENT HANDLING
             END DATE     5/77      PROBLEM: NOT DEFINED/SPECIFIED
                          THE QUALITY OF THE LIME SLURRY HAS BEEN A PROBLEM AREA.  ROCKS UP TO FIVE
                          INCHES IN DIAMETER HAVE BEEN DETECTED.  THIS HAS PROMPTED DRAVO TO INSTALL
                          MECHANICAL SEPARATORS AND METAL DETECTORS AT THE LIME SHIPMENT FACILITY.
             AFFECTED MODULES: SYSTEM

5/77   A
       B         58.0         50.0        51.0        48.0
       SYSTEM
                                                                            744   712
6/77   A
       B         66.0         59.0        60.0        58.0
       SYSTEM
                                                                            720   713

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   6/77      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     6/77      COMMENTS:
                          THE B-SIDE MODULE DID NOT OPERATE THE ENTIRE MONTH PENDING COMPLETION
                          OF A NUMBER OF NECESSARY MODIFICATIONS AND REPAIRS.
             AFFECTED MODULES: B

7/77   A
       B
       SYSTEM
                                                                            744   744
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-------------------------------------------PERFORMANCE DATA-------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ----- ----- ------

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    7/77      EQUIPMENT: PROCESS CONTROL
             END DATE      7/77      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                                     MODIFICATIONS WERE MADE TO THE UNIT PROCESS CONTROL SYSTEM.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    7/77      EQUIPMENT: INSTRUMENTATION
             END DATE      7/77      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                                     MODIFICATIONS WERE MADE TO THE UNIT INSTRUMENTATION SYSTEM.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    7/77      EQUIPMENT: ABSORBER
             END DATE      7/77      PROBLEM: INSTALLATION-RELATED MATERIALS FAILURE
                                     REPAIRS WERE MADE TO THE ABSORBER LINER.
             AFFECTED MODULES: B

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    7/77      EQUIPMENT: THICKENER
             END DATE      7/77      PROBLEM: CHEMICAL-RELATED PLUGGING
                                     REPAIRS WERE MADE TO THE PIPING BETWEEN THE THICKENER AND IUCS BUILDING.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    7/77      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE      7/77      COMMENTS: RESEARCH AND DEVELOPMENT
                                     THE UTILITY IS CURRENTLY PLANNING TO CONDUCT A PARTICULATE DROP TEST
                                     SCHEDULED FOR SEPTEMBER 1977.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    7/77      EQUIPMENT: ABSORBER
             END DATE      7/77      COMMENTS:
                                     THE REPLACEMENT A-SIDE TCA MODULE REPLACING THE ORIGINAL MODULE DESTROYED
                                     BY FIRE IN DECEMBER 1976 IS EXPECTED TO BE AVAILABLE FOR COMMERCIAL
                                     SERVICE IN JANUARY 1978.
             AFFECTED MODULES: A

 8/77   A
        B
        SYSTEM                                                                744

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    8/77      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE      8/77      COMMENTS:
                                     THE SCRUBBER WAS NOT OPERATED THE ENTIRE MONTH.  REPAIRS AND MODIFICATIONS
                                     CONTINUED UNTIL SEPTEMBER 13.  THERE WERE SOME WEATHER-RELATED DELAYS.
             AFFECTED MODULES: SYSTEM

 9/77   A
        B         52.9        39.9        46.9        26.0
        SYSTEM                                                                720   469

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    9/77      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE      9/77      COMMENTS: RESEARCH AND DEVELOPMENT
                                     THE PARTICULATE DROP TEST SCHEDULED FOR SEPTEMBER 1977 WAS PUSHED BACK TO
                                     THE WEEK OF OCTOBER 24 1977.
             AFFECTED MODULES: SYSTEM

10/77   A
        B         32.0        24.0        25.0        18.0
        SYSTEM                                                                744   559

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   10/77      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     11/77      COMMENTS:
```

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-------------------------------------------PERFORMANCE DATA----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL    PER  BOILER   FGD   CAP.
                                                                SO2  PART.  HOURS HOURS   HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                          THE SCRUBBER WAS DOWN FROM OCTOBER 10 TO NOVEMBER 10.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/77      EQUIPMENT: ABSORBER
             END DATE    10/77      PROBLEM: INSTALLATION-RELATED MATERIALS FAILURE
                          B-MODULE HAD TO BE RELINED IN SOME AREAS WITH NEOPRENE RUBBER.
             AFFECTED MODULES: B

11/77  A             10.0         4.0         4.0         4.0
       B             33.0        33.0        33.0        33.0
       SYSTEM                                                                720   715

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  11/77      EQUIPMENT: ABSORBER
             END DATE    11/77      COMMENTS:
                          MODULE A WENT BACK ON LINE NOVEMBER 21.  DURING LOW LOAD PERIODS SOLIDS
                          BUILD UP TENDED TO CAUSE PLUGGING BECAUSE OF LOW FLOW RATES.  DURING THE
                          LOW LOAD PERIODS ALL GAS WAS DUCTED THROUGH ONE MODULE WHILE THE OTHER WAS
                          SHUT DOWN.
             AFFECTED MODULES: SYSTEM

12/77  A             93.0        64.0        62.0        22.0
       B             97.0        79.0        76.0        27.0
       SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  12/77      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     3/78      COMMENTS:
                          THE UNIT WENT DOWN DECEMBER 12 FOR A 3-MONTH SCHEDULED OUTAGE.  MODULE A
                          BEGAN COMMERCIAL OPERATIONS DECEMBER 3 OPERATING AS MUCH AS POSSIBLE
                          THROUGH DECEMBER 12.  MODULE B OPERATED DECEMBER 1 THROUGH 12.  DURING THE
                          SHUTDOWN THE UTILITY WILL DECIDE IF THE SYSTEM SUPPLIERS HAVE MET SPECS
                          ON THE BOILER AND TURBINES.  THE UNIT IS SCHEDULED TO BE BACK ON LINE IN
                          MID-MARCH BUT THIS MAY BE PUSHED BACK TO APRIL 1.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  12/77      EQUIPMENT: STACK
             END DATE     3/78      PROBLEM: DESIGN-RELATED INFERIOR CONSTRUCTION MATERIAL
                          DURING THE DECEMBER TO MARCH 1978 SHUTDOWN THE CARBON STEEL FLUE WILL BE
                          REPLACED WITH AN ACID-BRICK LINING.
             AFFECTED MODULES: SYSTEM

1/78   A
       B
       SYSTEM                                                                744

2/78   A
       B
       SYSTEM                                                                672

3/78   A             20.0        19.0        64.0        10.0
       B             20.0                    54.0         8.0
       SYSTEM                                                                744   379

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   3/78      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     3/78      COMMENTS:
                          THE UNIT STARTED UP AGAIN ON MARCH 16.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   3/78      EQUIPMENT: GAS ANALYZER
             END DATE     3/78      PROBLEM: NOT DEFINED/SPECIFIED
                          PH CONTROLS AND SO2 ANALYZERS HAVE EXPERIENCED OPERATIONAL PROBLEMS.
             AFFECTED MODULES: SYSTEM
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------------------------------------------PERFORMANCE DATA-----------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ----- ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   3/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     3/78      PROBLEM: CHEMICAL-RELATED PLUGGING
                         IMPURITIES IN THE LIME HAVE CAUSED PLUGGING PROBLEMS.
            AFFECTED MODULES: SYSTEM

 4/78  A           67.0         58.0         61.0        58.0
       B           65.0         59.0         63.0        59.0
       SYSTEM                                                                    720   716

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   4/78      EQUIPMENT: THICKENER
            END DATE     4/78      PROBLEM: CHEMICAL-RELATED PLUGGING
                         THE SYSTEM WAS DOWN DUE TO AN EXCESS OF FLOCCULANT IN THE THICKENER.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   4/78      EQUIPMENT: ABSORBER
            END DATE     4/78      PROBLEM: CHEMICAL-RELATED PLUGGING
                         EXCESS FLOCCULANT IN THE THICKENER YIELDED A HIGH SOLIDS LEVEL IN THE
                         OVERFLOW AND RESULTED IN PLUGGING PROBLEMS IN THE ABSORBER MODULES.
            AFFECTED MODULES: SYSTEM

 5/78  A           52.0         45.0         45.0        44.0
       B           54.0         50.0         51.0        49.0
       SYSTEM                                                                    744   720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   5/78      EQUIPMENT: THICKENER
            END DATE     5/78      PROBLEM: CHEMICAL-RELATED PLUGGING
                         THE SYSTEM WAS TAKEN OUT OF SERVICE BECAUSE OF CONTINUED PROBLEMS WITH THE
                         FLOCCULANT FEED SYSTEM.  THE THICKENER WAS EMPTIED TO RESTORE PROPER FLOC-
                         CULANT BALANCE.
            AFFECTED MODULES: SYSTEM

 6/78  A           48.0         37.0         37.0        37.0
       B           30.0         30.0         30.0        30.0
       SYSTEM                                                                    720   720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   6/78      EQUIPMENT: PIPING
            END DATE     6/78      PROBLEM: NOT DEFINED/SPECIFIED
                         AN FRP PIPING FAILURE IN THE MIST ELIMINATOR WASH SYSTEM OCCURRED.
            AFFECTED MODULES: SYSTEM

 7/78  A           66.0         66.0         66.0        64.0
       B           43.0         33.0         33.0        32.0
       SYSTEM                                                                    744   727

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   7/78      EQUIPMENT: ABSORBER
            END DATE     7/78      PROBLEM: CHEMICAL-RELATED PLUGGING
                         OUTAGE TIME WAS DUE TO PLUGGING IN THE MIST ELIMINATOR AND SCRUBBER BALL
                         REGIONS.
            AFFECTED MODULES: SYSTEM SYSTEM

 8/78  A           18.0         20.0         20.0        18.0
       B           18.0         21.0         21.0        18.0
       SYSTEM                                                                    744   667

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/78      EQUIPMENT: MIST ELIMINATOR
            END DATE     8/78      PROBLEM: CHEMICAL-RELATED PLUGGING
                         THE FORCED OUTAGE TIME WAS DUE, IN PART, TO TIME REQUIRED TO REMOVE SCALE
                         FROM THE MIST ELIMINATOR.
            AFFECTED MODULES: SYSTEM
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                                   SECTION 3
                  DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
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-------------------------------------------PERFORMANCE DATA--------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   8/78      EQUIPMENT: ABSORBER
           END DATE     8/78      PROBLEM: DESIGN-RELATED INFERIOR CONSTRUCTION MATERIAL
                        THE FORCED OUTAGE TIME WAS DUE, IN PART, TO TIME REQUIRED TO REPLACE SOME
                        OF THE PING PONG BALLS IN THE MODULES.
           AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   8/78      EQUIPMENT: GAS DAMPER
           END DATE     9/78      PROBLEM: NOT DEFINED/SPECIFIED
                        THE UTILITY EXPERIENCED BYPASS DAMPER PROBLEMS DURING THE PERIOD.
           AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   8/78      EQUIPMENT: PIPING
           END DATE     9/78      PROBLEM: NOT DEFINED/SPECIFIED
                        PROBLEMS OCCURRED RELATED TO BROKEN SLUDGE LINES AND PLUGGING IN THE LIME
                        SLURRY FEED LINES.
           AFFECTED MODULES: SYSTEM

 9/78  A          61.0        46.0        55.0        45.0
       B          54.0        44.0        53.0        43.0
       SYSTEM                                                                720   707

10/78  A          72.0        37.0        38.0        36.0
       B          82.0        47.0        47.0        45.0
       SYSTEM                                                                744   713

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE  10/78      EQUIPMENT: GAS DAMPER
           END DATE    11/78      PROBLEM: NOT DEFINED/SPECIFIED
                        DAMPER DRIVE PROBLEMS WERE REPORTED BY THE UTILITY.
           AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE  10/78      EQUIPMENT: ABSORBER
           END DATE    11/78      PROBLEM: INSTALLATION-RELATED MATERIALS FAILURE
                        MINIMAL RUBBER LINER FAILURE WAS OBSERVED AT THE TOP OF ONE OF THE
                        SCRUBBER MODULES AND JUST AFTER THE PRESATURATOR.
           AFFECTED MODULES: SYSTEM

11/78  A          43.0        29.0        29.0        26.0
       B          84.0        74.0        75.0        66.0
       SYSTEM                                                                720   642

12/78  A           6.6          .3          .3          .3
       B          33.1        36.3        36.6        30.0
       SYSTEM                                                                744   609

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE  12/78      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE     1/79      PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                        THE LOW HOURS FOR THIS PERIOD ARE ATTRIBUTED TO FREEZE UPS.
           AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   0/ 0      EQUIPMENT:
           END DATE     0/ 0
                        THE LOW HOURS FOR THIS PERIOD ARE ATTRIBUTED TO FREEZE UPS.
           AFFECTED MODULES: SYSTEM

 1/79  A
       B
       SYSTEM                                                                744   602
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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COMPANY NAME                                   COLUMBUS & SOUTHERN OHIO ELEC.
PLANT NAME                                     CONESVILLE
UNIT NUMBER                                    6
CITY                                           CONESVILLE
STATE                                          OHIO
REGULATORY CLASSIFICATION                      B
PARTICULATE EMISSION LIMITATION - NG/J         ******         (****** LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                   430.         ( 1.000 LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW              2100.0
GROSS UNIT GENERATING CAPACITY - MW              411.0
NET UNIT GENERATING CAPACITY W/FGD - MW          375.0
NET UNIT GENERATING CAPACITY WO/FGD - MW         391.0
EQUIVALENT SCRUBBED CAPACITY - MW                411.0

** BOILER DATA
    SUPPLIER                                   COMBUSTION ENGINEERING
    TYPE                                       PULVERIZED COAL, DRY BOTTOM
    SERVICE LOAD                               BASE
    COMMERCIAL SERVICE DATE                     0/77
    MAXIMUM BOILER FLUE GAS FLOW - CU.M/S      ********       (******* ACFM)
    FLUE GAS TEMPERATURE - C                     146.7        ( 296 F)
    STACK HEIGHT - M                             244.         ( 800 FT)
    STACK TOP DIAMETER - M                     *******        (***** FT)

** FUEL DATA
    FUEL TYPE                                  COAL
    FUEL GRADE                                 BITUMINOUS
    AVERAGE HEAT CONTENT - KJ/KG                25237.        ( 10850 BTU/LB)
    RANGE HEAT CONTENT - BTU/LB                                10300-11220
    AVERAGE ASH CONTENT - %                       15.10
    RANGE ASH CONTENT - %                      12-19
    AVERAGE MOISTURE CONTENT - %                   7.50
    RANGE MOISTURE CONTENT - %                 ******
    AVERAGE SULFUR CONTENT - %                     4.67
    RANGE SULFUR CONTENT - %                   4.2-5.1
    AVERAGE CHLORIDE CONTENT - %               ********
    RANGE CHLORIDE CONTENT - %                 ******
    FUEL FIRING RATE - M T/H                     149.7        (165 TPH)
    FUEL FIRING RATE - MW                      *****

** ESP
    NUMBER                                      1
    TYPE                                       COLD SIDE
    SUPPLIER                                   RESEARCH COTTRELL

** FGD SYSTEM
    SALEABLE PRODUCT/THROWAWAY PRODUCT         THROWAWAY PRODUCT
    GENERAL PROCESS TYPE                       WET SCRUBBING
    PROCESS TYPE                               LIME
    PROCESS ADDITIVES                          THIOSORBIC
    SYSTEM SUPPLIER                            AIR CORRECTION DIVISION, UOP
    A-E FIRM                                   BLACK & VEACH
    DEVELOPMENT LEVEL                          FULL SCALE
    NEW/RETROFIT                               NEW
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %     99.60
    SO2 DESIGN REMOVAL EFFICIENCY - %             89.50
    COMMERCIAL DATE                             6/78
    INITIAL START-UP                            6/78
    CONSTRUCTION INITIATION                     5/75
    CONTRACT AWARDED                           10/74

** ABSORBER
    NUMBER                                      2
    TYPE                                       TURBULENT CONTACT ABSORBER
    INITIAL START UP                            6/78
    SUPPLIER                                   AIR CORRECTION DIVISION,UOP
    NUMBER OF STAGES                              4
    SHELL MATERIAL                             CARBON STEEL
    SHELL LINER MATERIAL                       NEOPRENE
    BOILER LOAD/ABSORBER - %                      60.0
    GAS FLOW - CU.M/S                            298.44       ( 632416 ACFM)
    GAS TEMPERATURE - C                          141.1        (  286 F)
    LIQUID RECIRCULATION RATE - LITER/S         2394.         (38000 GPM)
    PRESSURE DROP - KPA                            1.8        ( 7.3 IN-H2O)
    SUPERFICAL GAS VELOCITY - M/SEC                3.9        ( 12.8 FT/S)
```

** FANS

NUMBER	1

** VACUUM FILTER

NUMBER	1

** MIST ELIMINATOR

NUMBER	4
TYPE	CHEVRON
CONFIGURATION	HORIZONTAL

** MIST ELIMINATOR

NUMBER	2
TYPE	ENTRAINMENT SEPARATOR

** PUMPS

SERVICE	NUMBER
RECYCLE	1
TRANSFER TANK PUMP	1
MAKE-UP SLURRY PUMP	1
RECYCLE TANK SLUDGE PUMP	2
M.E. WASH TANK PUMP	2
RECLAIMED WATER PUMP	1

** TANKS

SERVICE	NUMBER
RECYCLE	1
RECLAIMED WATER TANK	1
SLURRY TRANSFER TANK	1
SLURRY STORAGE	1
M.E. WASH TANK	1

** THICKENER

CONSTRUCTION MATERIAL	CARBON STEEL WITH CONCRETE FLOOR	
DIAMETER - M	44.2	(145 FT)
OUTLET SOLIDS - %	32.5	

** WATER LOOP

TYPE	OPEN	
FRESH MAKEUP WATER ADDITION - LITERS/S	31.5	(500 GPM)

** TREATMENT

TYPE	PROPRIETARY (POZ-O-TEC)
CONTRACTOR	IUCS
PRODUCT CHARACTERISTICS	73% SOLIDS

** DISPOSAL

NATURE	FINAL
TYPE	DIKED LANDFILL
LOCATION	ON-SITE
TRANSPORTATION	PIPE
AREA - ACRES	50.0

PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
6/78	A	56.0	49.0	51.0	42.0						
	B	44.0	33.0	34.0	30.0						
	SYSTEM							720	524		

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 6/78 EQUIPMENT: GAS DAMPER
END DATE 6/78 PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
CONTROL OF THE LOUVERERED DAMPER OF THE BYPASS SYSTEM WAS LOST. THE RESULT WAS BACK PRESSURE BUILDUP THAT AUTOMATICALLY SHUT DOWN THE BOILER.
AFFECTED MODULES: SYSTEM

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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-----------------------------------------PERFORMANCE DATA--------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL     PER BOILER  FGD   CAP.
                                                                 SO2 PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   6/78     EQUIPMENT: INSTRUMENTATION
            END DATE     6/78     PROBLEM: NOT DEFINED/SPECIFIED
                         SCRUBBER CONTROLS WERE NOT OPERATING PROPERLY AND NEEDED ADJUSTMENT.
            AFFECTED MODULES: SYSTEM

7/78   A          83.0        37.0        63.0        25.0
       B          70.0        19.0        33.0        13.0
       SYSTEM                                                                744   502

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   7/78     EQUIPMENT: GAS DAMPER
            END DATE     7/78     PROBLEM: NOT DEFINED/SPECIFIED
                         THE LOUVERED DAMPER PROBLEM CONTINUED.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   7/78     EQUIPMENT: PIPING
            END DATE     7/78     PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                         THE FRP TRANSFER LINE FROM THE THICKENER TO THE IUCS SYSTEM RUPTURED AS A
                         RESULT OF A WATER HAMMER IN THE LINE AND HAD TO BE REPAIRED.
            AFFECTED MODULES: SYSTEM

8/78   A          47.0        50.0        66.0        43.0
       B          62.0        60.0        81.0        52.0
       SYSTEM                                                                744   642

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/78     EQUIPMENT: PIPING
            END DATE     8/78     PROBLEM: NOT DEFINED/SPECIFIED
                         PROBLEMS WERE ENCOUNTERED WITH THE SLUDGE LINE.  THE UTILITY REPORTS
                         THAT THIS IS TYPICALLY A HIGH MAINTENANCE AREA.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/78     EQUIPMENT: GAS DAMPER
            END DATE     8/78     PROBLEM: NOT DEFINED/SPECIFIED
                         PROBLEMS WERE ENCOUNTERED WITH THE BYPASS CONTROL DAMPERS.  THE UTILITY
                         REPORTS THAT THIS IS TYPICALLY A HIGH MAINTENANCE AREA.
            AFFECTED MODULES: SYSTEM

9/78   A          55.0        50.0        53.0        49.0
       B          69.0        55.0        57.0        54.0
       SYSTEM                                                                720   706

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/78     EQUIPMENT: REAGENT HANDLING
            END DATE     9/78     PROBLEM: NOT DEFINED/SPECIFIED
                         A PROBLEM AREA WAS THE PLUGGING OF THE LIME SLURRY FEED LINES.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/78     EQUIPMENT: GAS DAMPER
            END DATE     9/78     PROBLEM: NOT DEFINED/SPECIFIED
                         BY-PASS DAMPER CONTROL PROBLEMS CONTINUED THROUGH SEPTEMBER.
            AFFECTED MODULES: SYSTEM

10/78  A          98.0        29.0        30.0        24.0
       B          37.0        35.0        36.0        29.0
       SYSTEM                                                                744   603

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/78     EQUIPMENT: GAS DAMPER
            END DATE    10/78     PROBLEM: NOT DEFINED/SPECIFIED
                         PROBLEMS WITH DAMPER SEALS AND GUIDEBARS WERE ENCOUNTERED.  THE UTILITY
                         PLANS TO REPLACE THEM DURING THE NEXT BOILER OUTAGE.
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------------------------------------------PERFORMANCE DATA-----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
             AFFECTED MODULES: SYSTEM

11/78  B           26.0         9.0         6.0         8.0
       SYSTEM                                                                   720   480

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  11/78      EQUIPMENT: REAGENT HANDLING
             END DATE    11/78      PROBLEM: NOT DEFINED/SPECIFIED
                          LIME TRANSFER BAGHOUSE SHAKER PROBLEMS WERE EXPERIENCED.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  11/78      EQUIPMENT: AGITATOR
             END DATE    11/78      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                          THE THICKENER RAKE MOTOR BURNED OUT AND HAD TO BE REWOUND.
             AFFECTED MODULES: SYSTEM

12/78  A           34.8        26.3        26.8        24.2
       B           26.6        19.0        19.3        17.5
       SYSTEM                                                                   744   672

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  12/78      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     1/79      PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                          FREEZE UPS WERE A SERIOUS PROBLEM DURING THIS PERIOD.
             AFFECTED MODULES: SYSTEM

 1/79  A            5.0         2.0         2.0         2.0
       B
       SYSTEM                                                                   744   730
```

```
                          SECTION 3
          DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
--------------------------------------------------------------------------------

 COMPANY NAME                                  DUQUESNE LIGHT
 PLANT NAME                                    ELRAMA
 UNIT NUMBER                                   1-4
 CITY                                          ELRAMA
 STATE                                         PENNSYLVANIA
 REGULATORY CLASSIFICATION                     B
 PARTICULATE EMISSION LIMITATION - NG/J          43.         (  .100 LB/MMBTU)
 SO2 EMISSION LIMITATION - NG/J                 258.         (  .600 LB/MMBTU)
 NET PLANT GENERATING CAPACITY - MW             494.0
 GROSS UNIT GENERATING CAPACITY - MW            510.0
 NET UNIT GENERATING CAPACITY W/FGD - MW        475.0
 NET UNIT GENERATING CAPACITY WO/FGD - MW       493.0
 EQUIVALENT SCRUBBED CAPACITY - MW              510.0

 ** BOILER DATA
      SUPPLIER                                 BABCOCK AND WILCOX
      TYPE                                     PULVERIZED COAL
      SERVICE LOAD                             BASE
      COMMERCIAL SERVICE DATE                   0/52
      MAXIMUM BOILER FLUE GAS FLOW - CU.M/S    ********      (******* ACFM)
      FLUE GAS TEMPERATURE - C                 *******       (**** F)
      STACK HEIGHT - M                           122.        ( 400 FT)
      STACK TOP DIAMETER - M                   *******       (***** FT)

 ** ESP
      NUMBER                                    1
      SUPPLIER                                 RESEARCH COTTRELL

 ** MECHANICAL COLLECTOR
      SUPPLIER                                 RESEARCH COTTRELL

 ** PARTICULATE SCRUBBER
      TYPE                                     SO2 SCRUBBERS ACT AS PART. SCRUBBERS

 ** FGD SYSTEM
      SALEABLE PRODUCT/THROWAWAY PRODUCT       THROWAWAY PRODUCT
      GENERAL PROCESS TYPE                     WET SCRUBBING
      PROCESS TYPE                             LIME
      SYSTEM SUPPLIER                          CHEMICO
      A-E FIRM                                 GIBBS AND HILL, INC.
      DEVELOPMENT LEVEL                        FULL-SCALE
      NEW/RETROFIT                             RETROFIT
      PARTICULATE DESIGN REMOVAL EFFICIENCY - %   99.00
      SO2 DESIGN REMOVAL EFFICIENCY - %           83.00
      COMMERCIAL DATE                          10/75
      INITIAL START-UP                         10/75
      CONSTRUCTION INITIATION                  12/71
      CONTRACT AWARDED                         12/70

 ** ABSORBER
      NUMBER                                    5
      TYPE                                     VARIABLE THROAT VENTURI
      INITIAL START UP                         10/75
      SUPPLIER                                 CHEMICO
      NUMBER OF STAGES                            1
      DIMENSIONS                               30 DIA. X 60 HIGH
      SHELL MATERIAL                           MILD STEEL
      SHELL LINER MATERIAL                     CEILCOTE
      INTERNAL MATERIAL                        316L SS AND CEILCOTE
      GAS FLOW - CU.M/S                          254.83      ( 540000 ACFM)
      GAS TEMPERATURE - C                        150.6       (  303 F)
      LIQUID RECIRCULATION RATE - LITER/S       1008.        (16000 GPM)
      PRESSURE DROP - KPA                          7.5       (30.0 IN-H2O)
      PARTICULATE REMOVAL EFFICIENCY - %          99.0

 ** FANS
      TYPE                                     SCRUBBER I.D.
      CONSTRUCTION MATERIALS                   RUBBER LINED AND 316L SS HUBS
      SERVICE - WET/DRY                        WET

 ** PUMPS
      SERVICE                                  NUMBER
      -------                                  ------
      RECYCLE                                  ****
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 ** REHEATER
     TYPE                                         DIRECT COMBUSTION

 ** THICKENER
     NUMBER                                        2
     OUTLET SOLIDS - %                               32.0

 ** WATER LOOP
     TYPE                                         OPEN

 ** TREATMENT
     TYPE                                         POZ-O-TEC
     CONTRACTOR                                   IUCS
     PRODUCT CHARACTERISTICS                      70% SOLIDS

 ** DISPOSAL
     NATURE                                       FINAL
     TYPE                                         LANDFILL
     LOCATION                                     OFF SITE
     TRANSPORTATION                               TRUCK


-------------------------------------------PERFORMANCE DATA-------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

 0/75  SYSTEM

         ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   0/75     EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     0/75     COMMENTS:
                           THE FIRST ELRAMA SCRUBBER WAS PLACED IN SERVICE ON OCTOBER 26, 1975.  IT
                           HAD BEEN SCHEDULED FOR AN EARLIER STARTUP DATE BUT BECAUSE OF THE SEVERITY
                           AND NUMBER OF PROBLEMS ENCOUNTERED AT PHILLIPS, STARTUP WAS DELAYED UNTIL
                           MANY OF THE PROBLEMS AT PHILLIPS WERE RESOLVED AND THE MODIFICATIONS COULD
                           BE INCORPORATED AT BOTH STATIONS.
              AFFECTED MODULES: SYSTEM

         ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   0/75     EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     0/75     COMMENTS:
                           BOILER NO. 2 WAS INITIALLY CONNECTED TO THE FGD SYSTEM ON OCTOBER 26, 1975
                           THIS BOILER HAS AN EQUIVALENT CAPACITY OF APPROXIMATELY 100 MW AND THE
                           EMISSIONS ARE HANDLED BY ONE SCRUBBER.  TO ENSURE RELIABILITY IN THE CASE
                           OF A SCRUBBER MALFUNCTION, TWO SCRUBBERS ARE OPERATED AT PARTIAL LOAD TO
                           PROTECT THE BOILER AND TURBINE GENERATOR AGAINST A TRIP-OFF.
              AFFECTED MODULES: SYSTEM

         ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   0/75     EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     2/76     COMMENTS:
                           THE BOILER OPERATED CONTINUOUSLY ON THE SCRUBBER SYSTEM THROUGH JANUARY
                           1976.  TWO MINOR OUTAGES OCURRED.  ON FEBRUARY 4, 1976 A SECOND BOILER WAS
                           COUPLED INTO THE SCRUBBER COMPLEX.  PRESENTLY, 2 UNITS ARE THE MAXIMUM THA
                           CAN BE TIED INTO THE SCRUBBER PLANT.  TO DATE, THE UTILITY HAS ENCOUNTERED
                           THE USUAL MINOR STARTUP PROBLEMS AND SOME MAJOR PROBLEMS AS WELL.  THE MAJ
                           OR PROBLEMS HAVE BEEN FROZEN PIPES AND THICKENERS, THE LATTER INVOLVING
                           HARDWARE AND DESIGN ASSOCIATED WITH RECIRCULATION OF THE SLUDGE WITHIN THE
                           THICKENERS TO ATTAIN 30 TO 40 PERCENT SOLIDS CONCENTRATION.
              AFFECTED MODULES: SYSTEM

10/75  101
       301
       401
        501
       SYSTEM                                                             744

         ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  10/75     EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     2/76     COMMENTS:
                           ONE BOILER WAS CONNECTED TO THE SCRUBBER SYSTEM ON OCTOBER 26, 1975.  A SE
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---------------------------------------------PERFORMANCE DATA---------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                                   COND BOILER WAS CONNECTED ON FEBRUARY 4, 1976.  FOUR OF THE SCRUBBER VES-
                                   SELS HAVE BEEN IN SERVICE IN VARIOUS COMBINATIONS.  THE FIFTH VESSEL HAS
                                   NOT BEEN IN SERVICE BECAUSE IT IS BEING REVISED FOR TRIAL INSTALLATION OF
                                   RUBBER-LINED RECYCLE PUMPS.
                        AFFECTED MODULES: SYSTEM

11/75  SYSTEM                                                                  720

12/75  SYSTEM                                                                  744

 0/76  SYSTEM                                                                                      69.5

 1/76  SYSTEM                                                                  744

          ** PROBLEMS/SOLUTIONS/COMMENTS
                  START DATE    1/76      EQUIPMENT: REAGENT HANDLING
                  END DATE      1/76      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                                ONE OUTAGE WAS CAUSED BY A LIME FEEDER BELT FAILURE.
                  AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
                  START DATE    1/76      EQUIPMENT: SCRUBBER
                  END DATE      1/76      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                                ONE OUTAGE WAS CAUSED BY INOPERATIVE THROAT DAMPERS.
                  AFFECTED MODULES: SYSTEM

 2/76  SYSTEM                                                                  696

 3/76  SYSTEM                                                                  744

          ** PROBLEMS/SOLUTIONS/COMMENTS
                  START DATE    3/76      EQUIPMENT: FGD SYSTEM, GENERAL
                  END DATE      4/76      COMMENTS:
                                THE SYSTEM OPERATED DURING THE REPORT PERIOD WITH TWO BOILERS COUPLED INTO
                                THE SCRUBBING SYSTEM.  REVISIONS TO THE FIFTH SCRUBBING VESSEL HAVE BEEN
                                COMPLETED AND OPERATIONS ARE PROCEEDING WITH TWO RUBBER-LINED RECYCLE
                                PUMPS.
                  AFFECTED MODULES: SYSTEM

 4/76  SYSTEM                                                                  720

 5/76  SYSTEM                                                                  744

          ** PROBLEMS/SOLUTIONS/COMMENTS
                  START DATE    5/76      EQUIPMENT: FGD SYSTEM, GENERAL
                  END DATE      6/76      COMMENTS:
                                THE SYSTEM IS STILL OPERATING WITH TWO BOILERS COUPLED INTO THE SCRUBBING
                                SYSTEM.  THE IUCS SLUDGE FIXATION SYSTEM IS CONTINUING TO OPERATE AT THIS
                                STATION.
                  AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
                  START DATE    5/76      EQUIPMENT: RECYCLE PUMP
                  END DATE      6/76      COMMENTS:
                                THE FIFTH SCRUBBING VESSEL WAS TAKEN OUT OF SERVICE FOR REPAIRS AND MODIFI
                                CATIONS REQUIRED FOR THE RUBBER-LINED RECYCLE PUMPS.
                  AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
                  START DATE    5/76      EQUIPMENT:
                  END DATE      6/76      COMMENTS:
                                THE UTILITY IS CURRENTLY CONDUCTING A PERFORMANCE TEST ON THE SCRUBBING
                                SYSTEM IN THE TWO BOILER OPERATION MODE.
                  AFFECTED MODULES: SYSTEM

 6/76  SYSTEM                                                                  720

 7/76  SYSTEM                                                                  744
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---------------------------------------------PERFORMANCE DATA------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL    PER  BOILER   FGD   CAP.
                                                                SO2  PART.  HOURS  HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- -----  -----  -----  ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   7/76      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     8/76      COMMENTS:
                                   THE FIFTH SCRUBBING VESSEL EMPLOYING TWO RUBBER-LINED RECYCLE PUMPS WAS
                                   OPERATIONAL FOR A SHORT PERIOD OF TIME DURING THE REPORTING MONTHS. TWO
                                   BOILERS REMAIN COUPLED INTO THE SCRUBBING SYSTEM. THE CONSTRUCTION OF AD-
                                   DITIONAL LIME STORAGE SILOS AND A THICKENER WILL BE REQUIRED FOR FULL SCAL
                                   OPERATION. THE UTILITY HAS SIGNED A LETTER OF INTENT WITH IUCS FOR A LONG
                                   TERM SLUDGE FIXATION SYSTEM. HIGH CALCIUM LIME IS STILL BEING EMPLOYED IN
                                   THE SCRUBBING SYSTEM.
            AFFECTED MODULES: SYSTEM

 8/76  SYSTEM                                                                   744

 9/76  SYSTEM                                                                   720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/76      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    10/76      COMMENTS:
                                   OPERATIONS AT THIS STATION DURING THE REPORT PERIOD PROCEEDED WITH TWO
                                   BOILERS COUPLED INTO THE 5-MODULE SCRUBBING SYSTEM. THE 5TH SCRUBBING VES
                                   SEL WAS OPERATIONAL DURING THE REPORT PERIOD WITH THE RUBBER-LINED RECYCLE
                                   PUMPS IN SERVICE. OPERATIONS ARE STILL PROCEEDING ON AN OPEN WATER-LOOP
                                   BASIS. PART OF THE THICKENER OVERFLOW IS STILL BEING DIVERTED TO THE ASH
                                   POND AND NOT RECYCLED BACK TO THE PROCESS. BECAUSE BOTH THE BEAVER VALLEY
                                   AND BRUCE MANSFIELD STATIONS ARE FULLY OPERATIONAL, THIS STATION HAS BEEN
                                   RELEGATED TO PEAK LOAD OPERATIONS. GENERAL LOAD OPERATIONS ARE FULL LOAD
                                   CAPACITY IN THE DAYTIME AND 50 TO 60 PERCENT LOAD REDUCTION AT NIGHT.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/76      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    10/76      COMMENTS: RESEARCH AND DEVELOPMENT
                                   TESTS WERE CONDUCTED DURING THE PERIOD TO DETERMINE PARTICULATE AND SO2
                                   REMOVAL EFFICIENCIES. SO2 REMOVAL EFFICIENCY WAS 50 PERCENT. PARTICULATE
                                   EMMISSIONS WERE BEING REDUCED WELL BELOW 0.1 LB/MM BTU STANDARD (ACTUAL RE
                                   SULTS: 0.04 LB/MM BTU). THESE RESULTS WERE BASED ON TWO BOILERS COUPLED
                                   INTO THE 5 SCRUBBING MODULES WHILE BURNING MEDIUM-SULFUR (1.0 TO 2.8 PER-
                                   CENT) COAL. THE MECHANICAL COLLECTORS AND ESP'S WERE IN SERVICE DURING THE
                                   TESTS.
            AFFECTED MODULES: SYSTEM

10/76  SYSTEM                                                                   744

11/76  SYSTEM                                                                   720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/76      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    12/76      COMMENTS:
                                   THE SCRUBBER REMAINED IN SERVICE THROUGHOUT THE REPORT PERIOD WITH TWO
                                   BOILERS COUPLED INTO THE SCRUBBING SYSTEM. A RECYCLE PUMP EVALUATION IS
                                   BEING CONDUCTED BY THE UTILITY AT BOTH PHILLIPS AND ELRAMA STATIONS.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/76      EQUIPMENT: RECYCLE PUMP
            END DATE    12/76      PROBLEM: MECHANICAL-RELATED MATERIALS FAILURE
                                   OBSERVATIONS OF THE RUBBER-LINED RECYCLE PUMPS INDICATE SOME SEVERE ABRAS-
                                   ION AND GOUGING HAVE OCCURRED AFTER 1000 HOURS OF SERVICE TIME.
            AFFECTED MODULES: SYSTEM

12/76  SYSTEM                                                                   744

 1/77  SYSTEM                                                                   744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/77      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     3/77      COMMENTS: RESEARCH AND DEVELOPMENT
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PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR

TESTING ON THIOSORBIC LIME WAS CONDUCTED DURING THE PERIOD.

AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 1/77 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 3/77 COMMENTS:

THE SCRUBBER PLANT CONTINUED OPERATIONS DURING THE REPORT PERIOD WITH TWO BOILERS COUPLED INTO THE SYSTEM. INSTALLATION OF THE ADDITIONAL THICKENER LIME FEEDERS AND SILOS IS STILL IN PROGRESS. FULL COMPLIANCE OPERATION FOR THIS STATION IS SCHEDULED FOR EARLY 1978. THE FULL COMPLIANCE STRATEGY WILL CONSIST OF THE FOLLOWING: 83% SO2 REMOVAL FOR 2% SULFUR COAL UTILIZIN THIOSORBIC LIME (6-12% MG), FIXATING THE SCRUBBER SLUDGE WITH THE IUCS POZO-TEC STABILIZATION METHOD AND HAULING THIS MATERIAL TO AN OFF-SITE DISPOSAL/LANDFILL AREA. CURRENT SO2 AND PARTICULATE REMOVAL EFFICIENCIES ARE50 AND 99+%, RESPECTIVELY. THE INTERIM IUCS UNIT NOW IN SERVICE CONSISTS OF THE OLD MOHAVE PROTOTYPE PLUS A VACUUM FILTER. THE STABILIZATION MATERIAL HAS BEEN UTILIZED IN A PARKING LOT CONSTRUCTION PROJECT. IUCS HAS BEEN AWARDED A 10-YEAR CONTRACT FOR THE CONTINUED USE OF THIS SYSTEM FOR FUTURE PLANT OPERATIONS.

AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
2/77	SYSTEM							672			
3/77	SYSTEM					50.00	99.00	744			
4/77	SYSTEM							720			

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 4/77 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 5/77 COMMENTS:

CONSTRUCTION OF TWO 120-FOOT DIAMETER THICKENERS IS CONTINUING. DUE TO TH GOUGING OF THE RUBBER-LINED RECYCLE PUMPS DURING THEIR TESTING, THEY HAVE BEEN REMOVED. THE UTILITY IS CONSIDERING TRYING ANOTHER SET OF RUBBER-LINED PUMPS. DUQUESNE LIGHT ALSO IS CONTINUING EFFORTS TO OBTAIN ALTERNAT LANDFILL AREAS FOR SLUDGE DISPOSAL.

AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
5/77	SYSTEM							744			
6/77	SYSTEM							720			

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 6/77 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 7/77 COMMENTS:

DUQUESNE LIGHT REPORTED THE FOLLOWING ITEMS FOR THE ELRAMA SCRUBBER PLANT DURING THE REPORT PERIOD:

- TWO BOILERS (200 MW) WERE COUPLED INTO THE SCRUBBER PLANT.
- THE INTERIM IUCS STABILIZATION UNIT (MOHAVE PROTOTYPE) CONTINUED TO FIXATE SCRUBBER WASTES.
- CONSTRUCTION OF THE TWO ADDITIONAL THICKENERS CONTINUED (CONSTRUCTION IS ON SCHEDULE).
- FULL PLANT COMPLIANCE IS PROJECTED FOR FEBRUARY 1978.
- SO2 REMOVAL EFFICIENCY IS APPROXIMATELY 50%.
- ELRAMA IS OPERATING IN A BASE/INTERMEDIATE LOAD MODE (FULL LOAD DAYTIME/ HALF LOAD NIGHT-TIME). 1976 CAPACITY FACTOR WAS 69.5%.

AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
7/77	SYSTEM					50.00		744			
8/77	SYSTEM							744			

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 8/77 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 9/77 COMMENTS:

THE TWO ADDITIONAL THICKENERS WERE COMPLETELY INSTALLED. THE IUCS SYSTEM WAS UPGRADED. END OF CONSTRUCTION IS PROJECTED FOR FEBRUARY 1978. FULL PLANT COMPLIANCE IS PROJECTED FOR APRIL 1978.

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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-------------------------------------------PERFORMANCE DATA--------------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ----- ----- ------
          AFFECTED MODULES: SYSTEM

 9/77  SYSTEM                                                               720

10/77  SYSTEM                                                               744

       ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  10/77      EQUIPMENT: VALVES
          END DATE    10/77      PROBLEM: MECHANICAL-RELATED MATERIALS FAILURE
                      MODULE 101 WAS UNAVAILABLE OCTOBER 4 DUE TO A BLEED VALVE LEAK AND WAS TA-
                      KEN OUT OF SERVICE AT THE END OF THE MONTH FOR CLEANUP.
          AFFECTED MODULES: 101

       ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  10/77      EQUIPMENT: FGD SYSTEM, GENERAL
          END DATE    10/77      COMMENTS:
                      MODULE 201 WAS AVAILABLE FOR THE ENTIRE MONTH.
          AFFECTED MODULES: 201

       ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  10/77      EQUIPMENT: FAN
          END DATE    10/77      PROBLEM: MECHANICAL-RELATED MATERIALS FAILURE
                      MODULE 301 AND 401 HAD OUTAGES IN OCTOBER RESULTING FROM A RUBBER LINING
                      FAILURE ON AN I.D. FAN.
          AFFECTED MODULES: 301    401

       ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  10/77      EQUIPMENT: RECYCLE PUMP
          END DATE    11/77      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                      MODULE 501 EXPERIENCED RECYCLE PUMP OUTAGES IN LATE NOVEMBER.
          AFFECTED MODULES: 501

       ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  10/77      EQUIPMENT: FGD SYSTEM, GENERAL
          END DATE    11/77      COMMENTS:
                      NEW RUBBER LINED WORMEN RECYCLE PUMPS WERE INSTALLED.  THE LIME HANDLING
                      SYSTEM INSTALLATION WORK CONTINUED.  THE LAST TWO BOILERS ARE EXPECTED TO
                      BE TIED INTO THE FGD SYSTEM BY JANUARY 1978.
          AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  10/77      EQUIPMENT: BOILER-RELATED
          END DATE    11/77      COMMENTS:
                      TUBE LEAKS FORCED A BOILER OUTAGE IN NOVEMBER.
          AFFECTED MODULES: SYSTEM

11/77  101
       201
       301
       401
        501
       SYSTEM                                                               720

       ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  11/77      EQUIPMENT: FGD SYSTEM, GENERAL
          END DATE    11/77      COMMENTS:
                      MODULE 101, 201 AND 401 HAVE LOW OPERATIONAL HOURS BECAUSE ONLY TWO BOILER
                      ARE TIED INTO THE FGD SYSTEM TO DATE.
          AFFECTED MODULES: 101    201    401

       ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  11/77      EQUIPMENT: SLUDGE DISPOSAL
          END DATE    11/77      COMMENTS:
                      THE SLUDGE HANDLING SYSTEM IS FUNCTIONING PROPERLY AND IS NOW IN FULL SER-
                      VICE.
          AFFECTED MODULES: SYSTEM

12/77  SYSTEM                                                               744
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-------------------------------------------------PERFORMANCE DATA-----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ----- ----- ------

     ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  12/77      EQUIPMENT: RECYCLE PUMP
          END DATE     1/78      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                      DURING THE PERIOD A NEW WORMER RECYCLE PUMP INSTALLED IN NOVEMBER EXPERI
                      ENCED JACK SHAFT BEARING PROBLEMS RESULTING IN REMOVAL OF SCRUBBER TRAIN
                      501 FROM SERVICE.
          AFFECTED MODULES: 501

     ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  12/77      EQUIPMENT: FGD SYSTEM, GENERAL
          END DATE     1/78      COMMENTS:
                      BOILER NO. 4 WAS CONNECTED, ADDING AN ADDITIONAL 176 MW OF FLUE GAS LOAD T
                      THE FGD SYSTEM.
          AFFECTED MODULES: SYSTEM

     ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  12/77      EQUIPMENT: SLUDGE DISPOSAL
          END DATE     1/78      COMMENTS:
                      THE IUCS SLUDGE DISPOSAL FACILITY IS IN SERVICE PRODUCING GOOD PRODUCT.
                      LOW LOAD AND A COAL STRIKE HAVE HAMPERED GOOD SCRUBBER OPERATIONS.  THERE
                      IS SOME OUTAGE TIME SCHEDULED FOR MARCH.
          AFFECTED MODULES: SYSTEM

 1/78  101
       201
       301
       401
        501
       SYSTEM                                                                       744

 2/78  101
       201
       301
       401
        501
       SYSTEM                                                                       672

     ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE   2/78      EQUIPMENT: FGD SYSTEM, GENERAL
          END DATE     3/78      COMMENTS:
                      THE SYSTEM WAS SHUTDOWN ON FEBRUARY 11 AS A RESULT OF A COAL SHORTAGE.
                      BOILERS 1, 2 AND 4 ARE NOW COMPLETELY CONNECTED TO THE FGD SYSTEM.  BOILER
                      3 IS UNDERGOING AN EXTENSIVE OVERHAUL AND WILL BE CONNECTED TO THE SYSTEM
                      IN LATE APRIL.
          AFFECTED MODULES: SYSTEM

     ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE   2/78      EQUIPMENT: GAS DAMPER
          END DATE     3/78      PROBLEM: DESIGN-RELATED INFERIOR CONSTRUCTION MATERIAL
                      BOILER EXIT DAMPERS WERE LINED WITH 316 SS ON AREAS OF HIGH EROSION CAUSED
                      BY FLYASH IMPINGEMENT.
          AFFECTED MODULES: SYSTEM

     ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE   2/78      EQUIPMENT: EXPANSION JOINT
          END DATE     3/78      PROBLEM: DESIGN-RELATED INFERIOR CONSTRUCTION MATERIAL
                      EXPANSION JOINTS IN THE UPSTREAM DUCTWORK WERE SHIELDED BY METAL PLATES
                      WHICH WERE WELDED AT ONE END.  EXPANSION JOINTS IN THE DOWNSTREAM DUCTWORK
                      WERE COMPLETELY REPLACE.  THE DOWNSTREAM DUCTWORK WAS RELINED WITH
                      CEILCOTE.
          AFFECTED MODULES: SYSTEM

     ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE   2/78      EQUIPMENT: ABSORBER
          END DATE     3/78      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                      MODULE 401 INTERNALS WERE CLEANED AND SOME HOLES IN THE UPPER CONICAL RE-
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                                 SECTION 3
               DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
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------------------------------------PERFORMANCE DATA------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD    CAP.
                                                               SO2   PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                    GION WERE REPAIRED.
            AFFECTED MODULES: 401

 3/78  101

       301
       401
        501
       SYSTEM
                                                                           744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    4/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE      5/78      COMMENTS:
                          DURING THE APRIL-MAY PERIOD BOILER NUMBER 3 WAS STILL BEING OVERHAULED.
                          FGD SYSTEM CONSTRUCTION WAS COMPLETED AND PRELIMINARY TESTING VERIFIED SYS
                          TEM SO2 REMOVAL EFFICIENCY.
            AFFECTED MODULES: SYSTEM

 4/78  SYSTEM
                                                                           720

 5/78  SYSTEM
                                                                           744   547

 6/78  SYSTEM
                                                                           720   492

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    6/78      EQUIPMENT: ABSORBER
            END DATE      7/78      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                          MODULE 301 WAS PULLED OFF FOR A MAJOR CLEANING DURING THE PERIOD.
            AFFECTED MODULES: 301

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    6/78      EQUIPMENT: MIST ELIMINATOR
            END DATE      7/78      PROBLEM: CHEMICAL-RELATED PLUGGING
                          MIST ELIMINATOR PLUGGING WAS EXPERIENCED AS A RESULT OF LOW PH.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    6/78      EQUIPMENT: REAGENT HANDLING
            END DATE      6/78      PROBLEM: NOT DEFINED/SPECIFIED
                          THE CHRONIC INABILITY TO CONTROL CHEMISTRY (PH) IS DIRECTLY RELATED TO GRI
                          BUILD-UP IN THE LIME HANDLING AND SLURRY PREPARATION SYSTEM.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    6/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE      7/78      COMMENTS:
                          THE UTILITY IS CURRENTLY STUDYING WAYS TO TIGHTEN THE WATER BALANCE BY US-
                          ING THICKENER SUPERNATANT INTERMITTENTLY WITH CLEAR SERVICE WATER FOR THE
                          MIST ELIMINATORS.  A COMPLIANCE TEST SHOULD TAKE PLACE DURING THE NEXT RE-
                          PORT PERIOD.
            AFFECTED MODULES: SYSTEM

 7/78  SYSTEM
                                                                           744   662

 8/78  SYSTEM
                                                                           744   678

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    8/78      EQUIPMENT: ABSORBER
            END DATE      9/78      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                          DURING AUGUST, MODULES 301 AND 501 WERE TAKEN DOWN FOR CLEANING.
            AFFECTED MODULES: 301    501

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    8/78      EQUIPMENT: FAN
            END DATE      9/78      PROBLEM: MECHANICAL-RELATED MATERIALS FAILURE
                          RUBBER LINING ON THREE FAN HOUSINGS WAS REPAIRED.
            AFFECTED MODULES: SYSTEM
```

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-------------------------------------------PERFORMANCE DATA-----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------

          ** PROBLEMS/SOLUTIONS/COMMENTS
               START DATE   8/78     EQUIPMENT: REAGENT HANDLING
               END DATE     9/78     PROBLEM: PLUGGING, OTHER
                            IT WAS NECESSARY TO SHUT DOWN THE LIME MIXING BASIN IN ORDER TO CLEAN OUT
                            EXCESSIVE GRIT AND SOLIDS BUILD UP.
               AFFECTED MODULES: SYSTEM

  9/78  SYSTEM                                                                720   664

 10/78  SYSTEM                                                                744

 11/78  SYSTEM                                                                720

 12/78   101                                                 92.2
         201                                                 71.2
         301                                                 85.2
         401                                                 68.3
         501                                                 75.8
        SYSTEM                                                         .00    744   707

          ** PROBLEMS/SOLUTIONS/COMMENTS
               START DATE  12/78     EQUIPMENT: FGD SYSTEM, GENERAL
               END DATE    12/78     COMMENTS:
                            A COMPLIANCE TEST WAS RUN IN DECEMBER WHICH SHOWED THE UNITS TO BE IN
                            COMPLIANCE.
               AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
               START DATE  12/78     EQUIPMENT: SLUDGE DISPOSAL
               END DATE     1/79     COMMENTS:
                            THE UTILITY HAS STARTED HAVING SLUDGE OFF SITE TO AN AREA ABOUT 10 MILES
                            AWAY.
               AFFECTED MODULES: SYSTEM

  1/79  101                                                  40.1
        201                                                  91.9
        301                                                  59.9
        401                                                 100.0
         501                                                 96.8
        SYSTEM                                                                744   641
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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COMPANY NAME                                      DUQUESNE LIGHT
PLANT NAME                                        PHILLIPS
UNIT NUMBER                                       1-6
CITY                                              SOUTH HEIGHT
STATE                                             PENNSYLVANIA
REGULATORY CLASSIFICATION                         B
PARTICULATE EMISSION LIMITATION - NG/J              34.         (  .080 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                     258.         (  .600 LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW                 387.0
GROSS UNIT GENERATING CAPACITY - MW                410.0
NET UNIT GENERATING CAPACITY W/FGD - MW            377.0
NET UNIT GENERATING CAPACITY WO/FGD - MW           387.0
EQUIVALENT SCRUBBED CAPACITY - MW                  410.0

** BOILER DATA
    SUPPLIER                                      FOSTER-WHEELER
    TYPE                                          DRY BOTTOM, PULVERIZED COAL
    SERVICE LOAD                                  BASE
    COMMERCIAL SERVICE DATE                       **/**
    MAXIMUM BOILER FLUE GAS FLOW - CU.M/S           873.01      (1850000 ACFM)
    FLUE GAS TEMPERATURE - C                        182.2       ( 360 F)
    STACK HEIGHT - M                                104.        ( 340 FT)
    STACK TOP DIAMETER - M                        *******       (***** FT)

** FUEL DATA
    FUEL TYPE                                     COAL
    FUEL GRADE                                    ******
    AVERAGE HEAT CONTENT - KJ/KG                   26400.       ( 11350 BTU/LB)
    RANGE HEAT CONTENT - BTU/LB                                   ******
    AVERAGE ASH CONTENT - %                          18.20
    RANGE ASH CONTENT - %                         ******
    AVERAGE MOISTURE CONTENT - %                  ********
    RANGE MOISTURE CONTENT - %                    ******
    AVERAGE SULFUR CONTENT - %                        2.00
    RANGE SULFUR CONTENT - %                      1.0-2.8
    AVERAGE CHLORIDE CONTENT - %                  ********
    RANGE CHLORIDE CONTENT - %                    ******
    FUEL FIRING RATE - M T/H                      *******       (*** TPH)
    FUEL FIRING RATE - MW                         *****

** ESP
    NUMBER                                          6
    SUPPLIER                                      RESEARCH COTTRELL
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %        80.0

** MECHANICAL COLLECTOR
    NUMBER                                          6
    SUPPLIER                                      RESEARCH-COTTRELL

** FGD SYSTEM
    SALEABLE PRODUCT/THROWAWAY PRODUCT            THROWAWAY PRODUCT
    GENERAL PROCESS TYPE                          WET SCRUBBING
    PROCESS TYPE                                  LIME
    SYSTEM SUPPLIER                               CHEMICO
    A-E FIRM                                      GIBBS AND HILL
    DEVELOPMENT LEVEL                             FULL-SCALE
    NEW/RETROFIT                                  RETROFIT
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %        99.00
    SO2 DESIGN REMOVAL EFFICIENCY - %                83.00
    INITIAL START-UP                               7/73
    CONSTRUCTION COMPLETION                        7/73
    CONSTRUCTION INITIATION                       12/71
    CONTRACT AWARDED                               7/71
    STARTED REQUESTING BIDS                       10/70
    STARTED PRELIMINAY DESIGN                     12/69

** ABSORBER
    NUMBER                                          4
    TYPE                                          VARIABLE THROAT VENTURI
    INITIAL START UP                               7/73
    SUPPLIER                                      CHEMICO
    NUMBER OF STAGES                                  1
    DIMENSIONS                                    45 DIA. X 50 HIGH
    SHELL MATERIAL                                MILD STEEL
    SHELL LINER MATERIAL                          CEILCOTE
    INTERNAL MATERIAL                             316L SS AND CEILCOTE
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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      NOZZLE TYPE                                  TANGENTIAL, BULL NOZZLE
      GAS FLOW - CU.M/S                              258.13          ( 547000 ACFM)
      GAS TEMPERATURE - C                            171.1           (  340 F)
      SUPERFICAL GAS VELOCITY - M/SEC                 12.2           ( 40.0 FT/S)
      PARTICULATE OUTLET LOAD- G/CU.M                   .1           (  .040 GR/SCF)
      PARTICULATE REMOVAL EFFICIENCY - %              90.0
      SO2 INLET CONCENTRATION - PPM                 1400

** ABSORBER
      NUMBER                                         1
      TYPE                                         VARIABLE THROAT VENTURI (IN SERIES WITH 107)
      INITIAL START UP                              7/73
      SUPPLIER                                     CHEMICO
      NUMBER OF STAGES                                1
      DIMENSIONS                                   45 DIA. X 50 HIGH
      SHELL MATERIAL                               MILD STEEL
      SHELL LINER MATERIAL                         CEILCOTE
      INTERNAL MATERIAL                            316L SS AND CEILCOTE
      NOZZLE TYPE                                  TANGENTIAL, BULL NOZZLE
      GAS FLOW - CU.M/S                              258.13          ( 547000 ACFM)
      GAS TEMPERATURE - C                            171.1           (  340 F)
      SUPERFICAL GAS VELOCITY - M/SEC                 12.2           ( 40.0 FT/S)
      PARTICULATE OUTLET LOAD- G/CU.M                   .1           (  .040 GR/SCF)
      PARTICULATE REMOVAL EFFICIENCY - %              90.0
      SO2 INLET CONCENTRATION - PPM                 1400

** FANS
      NUMBER                                         4
      TYPE                                         SCRUBBER I.D.
      CONSTRUCTION MATERIALS                       316L SS(SHAFT); NATURAL RUBBER LINED HOUSING

** MIST ELIMINATOR
      NUMBER                                         8
      TYPE                                         CHEVRON
      PRESSURE DROP - KPA                              .5           ( 2.0 IN-H2O)

** PUMPS
      SERVICE                                      NUMBER
      -------                                      ------
      RECIRCULATION                                   1
      THICKENER OVERFLOW                              1
      THICKENER UNDERFLOW                             1
      LIME SLURRY                                     5
      LIME SLURRY(SPARE)                              1
      MAKE-UP WATER                                   1

** TANKS
      SERVICE                                      NUMBER
      -------                                      ------
      RECIRCULATION                                   1

** REHEATER
      NUMBER                                         1
      TYPE                                         DIRECT COMBUSTION
      TEMPERATURE BOOST - C                           11.1           (   20 F)

** THICKENER
      NUMBER                                         3
      CONSTRUCTION MATERIAL                        MILD STEEL, CEILCOTE LINED
      DIAMETER - M                                    22.9           ( 75 FT)
      OUTLET SOLIDS - %                               32.0

** WATER LOOP
      TYPE                                         OPEN

** TREATMENT
      TYPE                                         POZ-O-TEC
      CONTRACTOR                                   IUCS

** DISPOSAL
      NATURE                                       INTERIM
      TYPE                                         3-CLAY LINED PONDS
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

** DISPOSAL

NATURE	FINAL
TYPE	LANDFILL
LOCATION	OFF-SITE
TRANSPORTATION	TRUCK

PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
0/73	SYSTEM										

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 0/73 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 0/75 COMMENTS:

DETERMINATION OF THE AVAILABILITY OF THE PHILLIPS SYSTEM HAS BEEN DIFFCULT. UNTIL ALL BOILERS WERE CONNECTED TO THE SCRUBBERS, THERE WAS AT LEAST ONE SPARE TRAIN AND AS MUCH AS 100 PERCENT SPARE SCRUBBER CAPACITY. THEREFORE, HAVING A TRAIN OUT OF SERVICE FOR MAINTENANCE DID NOT REDUCE TH CAPABILITY OF THE SCRUBBER SYSTEM. UNTIL ALL SIX BOILERS WERE CONNECTED, MEANINGFUL AVAILABILITY FACTORS COULD NOT BE COMPUTED. ON MARCH 17, 1975, THE SIXTH BOILER WAS CONNECTED, AND ALL FOUR SCRUBBER TRAINS WERE REQUIRED TO BE IN SERVICE. OPERATION IN THAT MODE CONTINUED UNTIL AUGUST 4, 1975, WHEN THE NO. [illegible] BOILER WAS REMOVED FROM THE SCRUBBER SYSTEM BECAUSE THE PH LEVEL COULD NOT BE MAINTAINED AND DEPOSITS BECAME UNMANAGEABLE TO THE POIN THAT SCRUBBER OUTAGES WERE REDUCING GENERATING CAPABILITY OF THE STATION.

AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 0/73 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 0/75 COMMENTS:

STARTUP OF A PORTION OF THE PHILLIPS SCRUBBER SYSTEM BEGAN JULY 1973. SEVERAL PROBLEMS THEN DEVELOPED IN THE FORM OF EROSION OF FANS AND THE LIM FEED SYSTEM CAUSING OUTAGES OF THE SCRUBBER SYSTEM. AFTER AN EXTENDED OUTAGE, THE SCRUBBER SYSTEM WAS RETURNED TO SERVICE IN MARCH 1974. THE SYSTEM HAS BEEN OPERATING CONTINUOUSLY SINCE THAT TIME WITH VARIOUS NUMBER OF BOILERS CONNECTED TO THE SCRUBBER SYSTEM AND SCRUBBER TRAINS IN SERVICE

AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
7/73	SYSTEM		28.0	81.0				744		232	
8/73	SYSTEM							744			
9/73	SYSTEM							720			
10/73	SYSTEM							744			
11/73	SYSTEM							720			
12/73	SYSTEM							744			
1/74	SYSTEM							744			
2/74	SYSTEM							672			
3/74	SYSTEM							744			
4/74	SYSTEM							720			
5/74	SYSTEM							744			
6/74	SYSTEM							720			
7/74	SYSTEM							744			
8/74	SYSTEM							744			
9/74	SYSTEM							720			
10/74	SYSTEM							744			

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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--------------------------------------------PERFORMANCE DATA----------------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

11/74  SYSTEM                                                                720

12/74  SYSTEM                                                                744

 1/75  SYSTEM                                                                744

 2/75  SYSTEM                                                                672

 3/75  SYSTEM                                                                744

 4/75  SYSTEM                                                                720

 5/75  SYSTEM                                                    .00         744

 6/75  SYSTEM                                                                720

 7/75  101
       201
       301
       401
       SYSTEM                                                                744   506

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   7/75     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     7/75     COMMENTS:
                         THE FOURTH FGD TRAIN AND SIXTH BOILER WERE TIED IN ON MARCH 17, 1975.  PAR
                         TICULATE TESTS IN MAY SHOWED OUTLET LOADINGS OF 0.04 LB/MILLION BTU.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   7/75     EQUIPMENT: SCRUBBER
            END DATE     7/75     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                         THE 2-STAGE TRAIN HAS BEEN OUT OF SERVICE FROM JUNE 19 FOR GENERAL CLEANIN
                         AND REPAIR OF A LEAK IN THE FIRST-STAGE SCRUBBER.
            AFFECTED MODULES: SYSTEM

 8/75  301
       401
       101
       SYSTEM                                                                744   489

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/75     EQUIPMENT: SCRUBBER
            END DATE     8/75     PROBLEM: NOT DEFINED/SPECIFIED
                         SCRUBBER UNAVAILABILITY FORCED RETURNING BOILER (NO.6) TO THE SCRUBBER BY-
                         PASS PATH IN ORDER TO PREVENT LOSS OF BOILER CAPACITY.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/75     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     8/75     PROBLEM: CHEMICAL-RELATED PLUGGING
                         PLUGGING AND MAINTENANCE PROBLEMS HAVE BEEN ENCOUNTERED.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/75     EQUIPMENT: RECYCLE PUMP
            END DATE     8/75     PROBLEM: NOT DEFINED/SPECIFIED
                         EVALUATION OF VARIOUS RECYCLE PUMPS IS CONTINUING.
            AFFECTED MODULES; SYSTEM

 9/75  101
       201
       301
       401
       201
       SYSTEM                                                                720   519
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------------------------------------------PERFORMANCE DATA------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

10/75  101
       201
       301
       401
       SYSTEM                                                               744   619

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/75     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    10/75     COMMINTS: RESEARCH AND DEVELOPMENT
                          IN OCTOBER 1975, PHILLIPS INITIATED THIOSORBIC LIME SCRUBBING IN THEIR
                          SINGLE-STAGE MODULES ON AN EXPERIMENTAL BASIS.  THE PURPOSE IS TO STUDY
                          COMPLIANCE FEASIBILITY, SO2 REMOVAL EFFICIENCY, AND QUALITY OF THE SLUDGE
                          GENERATED BY THE SINGLE-STAGE MODULES.
             AFFECTED MODULES: SYSTEM

11/75  101
       201
       301
       401
       SYSTEM                                                               720   468

12/75  101
       201
       301
       401
       SYSTEM                                                               744   463

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  12/75     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    12/75     COMMENTS:
                          THE UTILITY CONCLUDED THE THIOSORBIC LIME TESTING PROGRAM IN MID-DECEMBER.
                          FOUR BOILERS WERE COUPLED TO THE SCRUBBING SYSTEM DURING THE RUN.  THE
                          UTILITY IS NOW ANALYZING THE DATA GENERATED DURING THE TEST PROGRAM.  THE
                          SCRUBBERS HAVE BEEN PUT BACK ON REGULAR LIME.  NO UNUSUAL PROBLEMS WERE EN
                          COUNTERED DURING THE TEST RUN.
             AFFECTED MODULES: SYSTEM

 1/76  101
       201
       301
       401

       SYSTEM      72.0                                                     744   493

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  1/76      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    1/76      COMMENTS:
                          THE 2.5-MONTH TEST PROGRAM WITH THIOSORBIC LIME INCLUDED 1612 HOURS ON ONE
                          TRAIN AND 130[illegible] HOURS ON ANOTHER TRAIN.  RESULTS INDICATE THAT THE REQUIRED
                          DEGREE OF SO2 REMOVAL (83 PERCENT) CAN BE OBTAINED WITH AN MGO CONTENT OF
                          8-10 PERCENT IN THE LIME WITH SINGLE-STAGE SCRUBBING.
             AFFECTED MODULES: SYSTEM

 2/76  101
       201
       301
       401
       SYSTEM                                                               696   485

 3/76  101
       201
       301
       401
       SYSTEM                                                               744

 4/76  SYSTEM                                                               720
```

```
-------------------------------------------PERFORMANCE DATA----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    4/76     EQUIPMENT: SCRUBBER
           END DATE      4/76     PROBLEM: CHEMICAL-RELATED PLUGGING
                          THE UTILITY IS STILL EXPERIENCING PROBLEMS WITH SOLIDS DEPOSITION IN THE
                          VENTURI THROAT OF THE SCRUBBING MODULE, CAUSING MOVEMENT INHIBITION AND
                          GREATER PRESSURE DROPS.
           AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    4/76     EQUIPMENT: SLUDGE DISPOSAL
           END DATE      4/76     COMMENTS:
                          THE SLUDGE STABILIZATION PRACTICES ARE STILL CONTINUING AT THIS FACILITY.
           AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    4/76     EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE      4/76     COMMENTS:
                          PLANT OPERATION IS PROCEEDING WITH A TOTAL OF FOUR BOILERS COUPLED INTO
                          SCRUBBING SYSTEM (EQUALING 336 MW, WHICH IS 87 PERCENT OF THE TOTAL PLANT
                          CAPACITY).  THE FGD SYSTEM OPERATED ON HIGH CALCIUM LIME DURING THE REPORT
                          PERIOD.  THE GENERAL OPERATION MODE AT THIS FACILITY HAS ONE OF THE FOUR
                          SCRUBBING TRAINS OUT CONTINUALLY FOR REPAIRS, CLEANING, AND PREVENTIVE
                          MAINTENANCE.  THE FGD SYSTEM AVAILABILITY FOR THE FIRST QUARTER OF 1976 WA
                          72 PERCENT.
           AFFECTED MODULES: SYSTEM

 5/76  SYSTEM                                                                      744

 6/76  SYSTEM                                                                      720

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    6/76     EQUIPMENT: BOILER-RELATED
           END DATE      6/76     COMMENTS:
                          REDUCED LOAD OPERATIONS WERE REPORTED BY THE UTILITY FOR THE MAY-JUNE
                          PERIOD BECAUSE OF A SCHEDULED TURBINE OVERHAUL ON UNIT NO. 6.
           AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    6/76     EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE      6/76     COMMENTS:
                          THE UTILITY IS PROCEEDING WITH THE INSTALLATION OF THREE ADDITIONAL LIME
                          STORAGE SILOS AND A THIRD THICKENER.
           AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    6/76     EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE      6/76     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                          THE SCRUBBING SYSTEM WAS SHUT DOWN ON JUNE 27 FOR A SCHEDULED FOUR WEEK
                          REPAIR PERIOD.  THE MAJORITY OF THE WORK WILL BE CONCENTRATED ON THE STACK
                          ASSOCIATED DUCTWORK AND BOILER DAMPERS.
           AFFECTED MODULES: SYSTEM

 7/76  SYSTEM                                                                      744

 8/76  SYSTEM                                                                      744

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    8/76     EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE      8/76     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                          THE FOUR-WEEK SYSTEM OVERHAUL WAS COMPLETED JULY 25.  THE THREE ADDITIONAL
                          LIME STORAGE SILOS AND THE FOUNDATION FOR THE ADDITIONAL 75-FOOT DIAMETER
                          THICKENER HAVE BEEN INSTALLED.  THE UTILITY HAS SIGNED A LETTER OF INTENT
                          WITH IUCS FOR A LONG-TERM SLUDGE TREATMENT SYSTEM.
           AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    8/76     EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE      8/76     PROBLEM: NOT DEFINED/SPECIFIED
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR

REPAIRS WERE MADE ON THE TURNING VANES TO THE SCRUBBER MIST ELIMINATOR.

AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 8/76 EQUIPMENT: EXPANSION JOINT

END DATE 8/76 COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE

REPAIR WORK WAS NECESSARY ON THE EXPANSION JOINT SEAL WHERE THE DUCTWORK TIES INTO THE MAIN STACK.

AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 8/76 EQUIPMENT: STACK

END DATE 8/76 COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE

THE STEEL BANDS AROUND THE INNER STACK STRUCTURE WERE REPAIRED.

AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 8/76 EQUIPMENT: FAN

END DATE 8/76 COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE

THE I.D. FANS WERE OVERHAULED.

AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 8/76 EQUIPMENT: GAS DAMPER

END DATE 8/76 COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE

THE BOILER EXIT DAMPERS WERE REPAIRED.

AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 8/76 EQUIPMENT: STACK

END DATE 8/76 COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE

REPAIRS WERE MADE TO STOP LEADKAGE OF THE ACID-BRICK LINING IN THE MAIN STACK.

AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
9/76	SYSTEM							720			

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 9/76 EQUIPMENT: FGD SYSTEM, GENERAL

END DATE 10/76 COMMENTS:

BOILER NUMBERS 2 THROUGH 6 WERE COUPLED INTO THE SCRUBBING SYSTEM. BOILER NO. 1 IS DOWN FOR OVERHAUL AND REPAIRS. THE IUCS INTERIM SLUDGE PROCESSING PLANT IS UNDER CONSTRUCTION AND WILL BE IN SERVICE BY DECEMBER 1976. THE TEMPORARY FACILITIES WILL PROCESS THE THICKENER UNDERFLOW AND PONDED SLUDGE UNTIL THE POND IS DEPLETED OF SLUDGE AND THE PERMANENT FACILITY HAS BEEN INSTALLED. SCRUBBING OPERATIONS ARE STILL PROCEEDING IN AN OPEN WATE LOOP MODE WITH PART OF THE THICKENER OVERFLOW BEING DIVERTED TO THE ASH POND. BECAUSE BOTH THE BEAVER VALLEY AND BRUCE MANSFIELD STATIONS ARE FULLY OPERATIONAL, THIS STATION HAS BEEN RELEGATED TO PEAK LOAD OPERATIONS GENERAL LOAD OPERATIONS ARE FULL LOAD CAPACITY IN THE DAYTIME AND 50 TO 67 PERCENT LOAD REDUCTION AT NIGHT.

TOTAL SCRUBBER HOURS: 23,274
TOTAL BOILER HOURS: 83,642
TOTAL SCRUBBER OUTAGE TIME: 5,500
TOTAL SCRUBBER AVAILABLE HOURS: 23,274
AVERAGE MW LOAD/SCRUBBER OPERATION HOUR: [illegible]43
TOTAL OPERABILITY INDEX: 28%
TOTAL RELIABILITY INDEX: 81%

THE FIGURES AT THE LEFT WERE COMPILED BY THE UTILITY FOR SYSTEM OPERATIONS FOR THE PERIOD FOLLOWING START-UP IN JULY 1973 INCLUSIVE TO OCTOBER 1976. THE TOTAL SCRUBBER HOURS VALUE INCLUD OPERATION TIME WHEN ONE OR MORE OF THE MODULES WERE IN SERVICE. TOTAL BOILER AND UNAVAILABILITY VALUES APPL FOR ALL THE CORRESPONDING UNITS. THE TOTAL SCRUBBER AVAILABILITY INDEX INCLUDES THE TIME WHEN ONE OR MORE MODULES WERE AVAILABLE FOR SERVICE.

AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 9/76 EQUIPMENT: SLUDGE DISPOSAL

END DATE 10/76 COMMENTS:

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-----------------------------------------PERFORMANCE DATA------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
                    UNTIL THE IUCS INTERIM SLUDGE PROCESSING PLANT IS COMPLETE THE TEMPORARY
                    FACILITIES WILL PROCESS THE THICKENER UNDERFLOW AND PONDED SLUDGE UNTIL TH
                    POND IS DEPLETED OF SLUDGE.
            AFFECTED MODULES: SYSTEM

10/76   SYSTEM                                                             744

11/76   SYSTEM                                                             720

        ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/76      EQUIPMENT: RECYCLE PUMP
            END DATE    12/76      COMMINTS: RESEARCH AND DEVELOPMENT
                    THE RECYCLE PUMP EVALUATION IS CONTINUING.
            AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/76      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    12/76      COMMINTS:
                    THE UTILITY REPORTED THAT BOILERS TWO THROUGH SIX REMAINED COUPLED INTO TH
                    SCRUBBING SYSTEM DURING THE REPORT PERIOD.  THF INTERIM IUCS FIXATION
                    FACILITY WAS INSTALLED AND COMMENCED OPERATIONS IN DECEMBER.  THE UTILITY
                    REPORTED THAT THE VENTURI SCRUBBERS ARE STILL DEVELOPING LARGE AMOUNTS OF
                    SCALE ON THE INTERNALS, RESULTING IN TWICE NORMAL PRESSURE DROPS.  THE RE-
                    CYCLE PUMP EVALUATION HAS BEEN IN PROGRESS.  APPROXIMATELY 2500 TO 2800
                    HOURS OF OPERATION TIME HAVE BEEN ACCUMULATED ON THE VARIOUS UNITS WITH NO
                    FAILURES OR APPRECIABLE WEAR OBSERVED.  THE ADDITIONAL DEWATERING AND RE-
                    AGENT PREPARATION EQUIPMENT IS NOW BEING INSTALLED.  THE CONTRACT HAS BEEN
                    AWARDED TO DRAVO TO PROVIDE THIOSORBIC LIME FOR THIS SCRUBBING SYSTEM.  AL
                    BOILERS HAVE BEEN HEADERED INTO THE SCRUBBER PLANT.  A NUMBER OF THE UNITS
                    WERE DOWN FOR OVERHAUL AND REPAIR.  THE INTERIM IUCS AOZ-O-TEC UNIT REMAIN
                    ED IN SERVICE, FILTERING OUT WATER ONLY.  THE RECYCLE PUMP EVALUATION IS
                    CONTINUING.  AFTER 4000 HOURS OF OPERATION THE CARBORUNDUM IMPELLERS AND
                    WEAR RINGS STILL LOOK GOOD.  SO2 AND PARTICULATE REMOVAL EFFICIENCIES ARE
                    50 AND 99+% RESPECTIVELY.  INSTALLATION OF THE ADDITIONAL SILOS, THICKENER
                    AND LIME FEEDERS IS STILL IN PROGRESS.  FULL COMPLIANCE PLANT OPERATIONS
                    ARE SCHEDULED FOR DECEMBER.
            AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/76      EQUIPMENT: SCRUBBER
            END DATE    12/76      PROBLEM: CHEMICAL-RELATED SCALING
                    THE VENTURI SCRUBBERS ARE STILL DEVELOPING LARGE AMOUNTS OF SCALE ON THE
                    INTERNIALS.  THE PRESSURE DROPS HAVE DOUBLED AS A RESULT.
            AFFECTED MODULES: SYSTEM

12/76   SYSTEM                                             50.00 99.00     744

 1/77   301
        401
        101
        201
        SYSTEM                                                             744

        ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/77      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     3/77      COMMENTS:
                    1977 FULL COMPLIANCE OPERATIONS WILL INCLUDE 83% SO2 REMOVAL FOR 2% SULFUR
                    COAL UTILIZING THIOSORBIC LIME (6-12% MG) AND FIXATING THE SCRUBBER WASTES
                    WITH THE IUCS POZ-O-TEC METHOD.  THE FIXATED MATTER WILL BE HAULED AWAY TO
                    AN OFF-SITE DISPOSAL AND LANDFILL.  IUCS HAS BEEN AWARDED A TEN YEAR CON-
                    TRACT FOR THE USE OF THIS METHOD.  THE CARBORUNDUM IMPELLORS AND WEAR RING
                    CONTINUE TO LOOK GOOD AFTER MORE THAN 5000 HOURS OF OPERATION.
            AFFECTED MODULES: SYSTEM

 2/77   SYSTEM                                                             672

 3/77   SYSTEM                                                             744
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------------------------------------PERFORMANCE DATA-----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------

 4/77  SYSTEM                                                                    720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    4/77      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE      5/77      COMMENTS:
                          DAMPER AND MIST ELIMINATOR REPAIRS WILL BE CORRECTED DURING A SCHEDULED
                          OUTAGE.  OVERALL SCRUBBER AVAILABILITY IS ABOUT 75%.  THE INTERIM SLUDGE
                          DISPOSAL SYSTEM IS STILL OPERATIONAL.  THE PERMANENT SLUDGE DISPOSAL FACIL
                          ITY IS ON SCHEDULE FOR THE DECEMBER 1977 COMPLETION DATE.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    4/77      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE      5/77      COMMENTS: RESEARCH AND DEVELOPMENT
                          THIOSORBIC LIME TESTS BEGAN IN LATE MAY BUT LASTED ONLY ABOUT ONE WEEK.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    4/77      EQUIPMENT: DUCTWORK
            END DATE      5/77
                          THE SCRUBBER SYSTEM WAS SHUT DOWN FOR THREE TO FOUR DAYS IN MAY DUE TO
                          LEAKING IN THE WET DUCT HEADER THAT LEADS TO THE STACK.  WHEN THE LEAK WAS
                          REPAIRED FLUE GAS FROM FOUR BOILERS BEGAN TO BE SCRUBBED.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    4/77      EQUIPMENT: GAS DAMPER
            END DATE      5/77      PROBLEM: CHEMICAL-RELATED EROSION
                          WHILE FIXING A DUCT LEAK INSPECTION OF OTHER COMPONENTS REVEALED THAT THE
                          BOILER EXIT DAMPERS WERE ERODING.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    4/77      EQUIPMENT: MIST ELIMINATOR
            END DATE      5/77      PROBLEM: CHEMICAL-RELATED PLUGGING
                          ONE 201 EXTERNAL MIST ELIMINATOR WAS SEVERLY ERODED AND PLUGGED.
            AFFECTED MODULES: 201

 5/77  SYSTEM      75.0                                                          744

 6/77  SYSTEM                                                                    720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    6/77      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE      7/77      COMMENTS:
                          ALL SIX BOILERS ARE COUPLED INTO THE SCRUBBER PLANT.  FLUE GAS FROM FIVE O
                          THESE UNITS IS BEING TREATED BY THE SCRUBBERS.  ONLY FOUR OF THE SIX BOIL-
                          ERS ARE ACTUALLY OPERATING BECAUSE OF THE CURRENT TURBINE REPAIR OUTAGE.
                          OPERATIONS ARE PROCEEDING WITH ONE SCRUBBING TRAIN BEING SPARED AT ALL
                          TIMES (MAINTENANCE AND CLEANOUT).  SO2 REMOVAL EFFICIENCY IS APPROXIMATELY
                          50%.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    6/77      EQUIPMENT: BOILER-RELATED
            END DATE      7/77      COMMENTS:
                          BOILER NO. 6 HAS BEEN DOWN FOR AN EXTENDED TURBINE REPAIR OUTAGE.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    6/77      EQUIPMENT: RECYCLE PUMP
            END DATE      7/77      COMMENTS: RESEARCH AND DEVELOPMENT
                          THE RECYCLE PUMP EVALUATION STUDY CONTINUED DURING THE PERIOD.  COMPONENTS
                          BEING EVALUATED INCLUDE: CARBORUNDUM IMPELLERS, CARBORUNDUM WEAR RINGS, TI
                          TANIUM IMPELLERS, 317SS WEAR RINGS (STELLITE TIPPED).
            AFFECTED MODULES: SYSTEM
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-------------------------------------------PERFORMANCE DATA-------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION % REMOVAL    PER BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   6/77     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     7/77     COMMINTS: RESEARCH AND DEVELOPMENT
                          A THIOSORBIC LIME TEST WAS PREMATURELY TERMINATED BECAUSE OF SOME MINOR
                          SLAKER/FEEDER PROBLEMS.  HIGH CALCIUM VIRGIN LIME WAS UTILIZED DURING THE
                          MAJORITY OF OIFRATIONS THROUGHOUT THE PERIOD.
             AFFECTED MODULES: SYSTEM

 7/77  SYSTEM                                                                744

 8/77  SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   8/77     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     9/77     COMMINTS:
                          LIME HANDLING AND SOLID WASTE DISPOSAL FACILITIES WERE BEING SCALED UP TO
                          HANDLE FULL CAPACITY AND A THIRD THICKENER WAS INSTALLED AND BROUGHT INTO
                          SERVICE DURING THIS REPORT PERIOD.  THE IUCS SYSTEM IS IN THE INTERIM
                          PHASE.  WASTE WATER IS BEING MIXED WITH FLYASH AND DISPOSED OF.  CURRENT
                          CONSTRUCTION WORK IS EXPECTED TO BE COMPLETED BY THE END OF JANUARY WHEN
                          ALL SIX BOILERS WILL BE BACK ON LINE FOR A TWO MONTH TEST PERIOD.  THIO-
                          SORBIC LIME IS STILL BEING TESTED.  RESULTS ARE NOT YET AVAILABLE.  THE FG
                          SYSTEM WILL BE DOWN FOR THE FIRST WEEKEND OF NOVEMBER.  THE SYSTEM WILL
                          ALSO BE CHECKED FOR MAIN DUCT LEAKS AT THIS TIME.  THE SCRUBBER AND STACK
                          LININGS AND RECYCLE PUMPS WILL BE THOROUGHLY CHECKED AS WELL.  NECESSARY
                          REPLACEMENTS AND REPAIRS WILL BE CARRIED OUT.  CURRENT SO2 REMOVAL EFF-
                          ICIENCY IS 50%.  BY EARLY APRIL THE SYSTEM IS EXPECTED TO REACH COMPLIANCE
                          WITH AN SO2 REMOVAL EFFICIENCY OF 83%.
             AFFECTED MODULES: SYSTEM

 9/77  SYSTEM                                                   50.00         720

10/77  101
       301
       401
       SYSTEM                                                                 744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/77     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    10/77     PROBLEM: NOT DEFINED/SPECIFIED
                         MODULE 101 WAS DOWN A TOTAL OF 113 HOURS IN OCTOBER.
             AFFECTED MODULES: 101

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/77     EQUIPMENT: SCRUBBER
             END DATE    10/77     COMMINT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                         MODULE 201 WAS PUT IN SERVICE ON OCTOBER 26 AFTER EXTENSIVE CLEAN UP AND
                         REPAIRS TO RUBBER LINING AND I.D. FAN.
             AFFECTED MODULES: 201

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/77     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    10/77     COMMINTS:
                         MODULE 301 WAS DOWN A TOTAL OF 57 HOURS IN OCTOBER.
             AFFECTED MODULES: 301

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/77     EQUIPMENT: FAN
             END DATE    10/77     PROBLEM: MECHANICAL-RELATED MATERIALS FAILURE
                         MODULE 401 WAS DOWN A TOTAL OF 36 HOURS IN OCTOBER FOR REPAIR OF HOLES IN
                         FAN LINING AND TYING IN THICKENER BLEED LINE.
             AFFECTED MODULES: 401

11/77  SYSTEM                                                                 720

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  11/77     EQUIPMENT: DUCTWORK
             END DATE    11/77
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-----------------------------------------PERFORMANCE DATA-----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
                     DURING THE SHUTDOWN OUTLET DUCT LEAKS WERE REPAIRED.
          AFFECTED MODULES: SYSTEM

     ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  11/77      EQUIPMENT: DUCTWORK
          END DATE    11/77
                     BOILER EXIT DAMPERS WERE REPLACED DUE TO EROSION BY FLYASH.
          AFFECTED MODULES: SYSTEM

     ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  11/77      EQUIPMENT: STACK
          END DATE    11/77
                     CORROSION OF STEEL BANDS IN STACK WAS DISCOVERED DURING THE PERIOD.
          AFFECTED MODULES: SYSTEM

     ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  11/77      EQUIPMENT: SLUDGE DISPOSAL
          END DATE    11/77      PROBLEM: NOT DEFINED/SPECIFIED
                     DEWATERING OPERATIONS ARE NOT WORKING PROPERLY, CAUSING PROBLEMS IN SLUDGE
                     HANDLING.
          AFFECTED MODULES: SYSTEM

     ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  11/77      EQUIPMENT: FGD SYSTEM, GENERAL
          END DATE    11/77      COMMENTS:
                     THE RESULTS FROM THIOSORBIC LIME USE CAN NOT YET BE QUANTIFIED DUE TO LIME
                     FEED SYSTEM PROBLEMS.
          AFFECTED MODULES: SYSTEM

     ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  11/77      EQUIPMENT: REAGENT HANDLING
          END DATE    11/77      PROBLEM: NOT DEFINED/SPECIFIED
                     LIME FEED SYSTEM PROBLEMS OCCURRED OVER THE PERIOD.
          AFFECTED MODULES: SYSTEM

12/77  SYSTEM                                                                744

     ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  12/77      EQUIPMENT: FGD SYSTEM, GENERAL
          END DATE    1/78       COMMENTS:
                     CUMULATIVE HOURS FOR JANUARY 1977 THROUGH 1-8-78 WERE 22391 FOR MODULE 101
                     ,20998 FOR MODULE 201, 22229 FOR MODULE 301 AND 22259 FOR MODULE 401.
          AFFECTED MODULES: SYSTEM

     ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  12/77      EQUIPMENT: SCRUBBER
          END DATE    1/78       COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                     SCRUBBER TRAIN 301 WAS DOWN FOR AN OVERHAUL FROM NOVEMBER 17 TO MONDAY FE-
                     BRUARY 6, 1978 WHEN IT WAS RETURNED TO SERVICE.
          AFFECTED MODULES: 301

     ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  12/77      EQUIPMENT: FGD SYSTEM, GENERAL
          END DATE    1/78       COMMENTS:
                     SCRUBBER TRAIN 401 WAS REMOVED FROM SERVICE ON THE 6TH OF FEBRUARY.
          AFFECTED MODULES: 401

     ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  12/77      EQUIPMENT: SLUDGE DISPOSAL
          END DATE    1/78       PROBLEM: NOT DEFINED/SPECIFIED
                     THE IUCS INTERIM SLUDGE TREATMENT SYSTEM HAS SOME DEWATERING PROBLEMS
                     DURING DECEMBER PHILLIPS EXPERIENCED POOR SLUDGE REMOVAL.  THE IUCS PLANT
                     IS WORKING ON A PART TIME BASIS. FULL OPERATIONS ARE EXPECTED LATE THIS
                     SPRING.  THE POOR QUALITY SLUDGE IS SENT TO AN EMERGENCY POND AND THEN RE-
                     CIRCULATED BACK TO THE THICKENER
          AFFECTED MODULES: SYSTEM
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---------------------------------------PERFORMANCE DATA----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/77     EQUIPMENT: REAGENT HANDLING
            END DATE     1/78     COMMENTS: RESEARCH AND DEVELOPMENT
                        TESTING WITH THIOSORBIC LIME AT 5% MGO HAS SHOWN THAT THE MGO CONCENTRATI-
                        ON IS NOT GREAT ENOUGH TO EFFECT ADEQUATE SO2 REMOVAL ON A SINGLE STAGE
                        SCRUBBER.  THEY ARE GOING TO TEST AT A GREATER MGO CONCENTRATION BY START-
                        ING AT 10% AND THEN DROPPING BACK UNTIL THE CONCENTRATION IS SATISFACTORY.
                        THIS TESTING, AS WELL AS SCRUBBER OPERATIONS, HAVE, HOWEVER, BEEN HAMPER-
                        ED BY LOW LOADS AS A RESULT OF THE COAL STRIKE.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/77     EQUIPMENT: STACK
            END DATE     1/78
                        THERE WILL BE AN OUTAGE AT PHILLIPS RO REPLACE THE CARBON STEEL BANDS IN
                        THE STACK WITH STAINLESS STEEL BANDS.
            AFFECTED MODULES: SYSTEM

 1/78  301
       401
       101
       201
       SYSTEM                                                                 744          421

 2/78  101
       201
       301
       401
       SYSTEM                                                                 672          167

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   2/78     EQUIPMENT: STACK
            END DATE     3/78
                        AN OUTAGE OCCURRED BETWEEN JANUARY 6 AND JANUARY 8 WHEN THE STACK DRAIN
                        LEAKS WERE REPAIRED BY SANDBLASTING THE OUTER WALL AND REPLACING THE CAR-
                        BON STEEL BANDS WITH STAINLESS STEEL BANDS.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   2/78     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     3/78     COMMINTS:
                        THE SYSTEM WAS SHUTDOWN ON FEBRUARY 11 DUE TO THE COAL SHORTAGE.  THE OUT-
                        AGE CONTINUED THROUGH MARCH AND THE SYSTEM IS SCHEDULED TO BE ON LINE BY
                        APRIL 15.  DURING THE OUTAGE A NUMBER OF REPAIRS AND MODIFICATIONS WERE
                        MADE.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   2/78     EQUIPMENT: GAS DAMPER
            END DATE     3/78     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                        THE BOILER EXIT DAMPERS WERE LINED WITH 316SS ON AREAS OF HIGH EROSION
                        CAUSED BY FLYASH INPINGEMENT.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   2/78     EQUIPMENT: EXPANSION JOINT
            END DATE     3/78     COMMINT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                        EXPANSION JOINTS ON THE INLET DUCTWORK WERE SHIELED BY METAL PLATES WHICH
                        WERE WELDED AT ONE END.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   2/78     EQUIPMENT: DUCTWORK
            END DATE     3/78     COMMINT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                        NUMEROUS HOLES IN THE WET GAS DUCT WORK WERE REPAIRED AND THE DUCTS WERE
                        RELINED WITH CEILCOTE.
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------------------------------------------PERFORMANCE DATA------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD    CAP.
                                                                SO2  PART. HOURS HOURS  HOURS  FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ -----  ------
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   2/78     EQUIPMENT: GAS DAMPER
             END DATE     3/78     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                                   THE THROAT DAMPERS WERE CLEANED ON ALL THE SCRUBBERS.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   2/78     EQUIPMENT: MIST ELIMINATOR
             END DATE     3/78     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                                   INTERNAL MIST ELIMINATORS WERE CLEANED.  THE EXTERNAL MIST ELIMINATORS,
                                   WHICH ARE BADLY DETERIORATED, MAY BE REPLACED.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   2/78     EQUIPMENT: STACK
             END DATE     3/78     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                                   THE STACK BRICKLINING WAS INSPECTED AND SOME BRICKS WERE REPLACED AT THE
                                   TOP OF THE STACK.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   2/78     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     3/78     COMMENTS:
                                   CONSTRUCTION WORK ON ADDITIONAL EQUIPMENT SUCH AS THE THICKENER AND SILOS
                                   IS ALMOST COMPLETE.  IT WAS NOTED THAT THE CEILCOTE LINER COROLINE 505AR
                                   HAS HELD UP WILL OVER THREE YEARS ON THE CONICAL APEX OF MODULE 401.
             AFFECTED MODULES: SYSTEM 401

3/78   SYSTEM
                                                                            744
4/78   SYSTEM
                                                                            720   402
       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   4/78     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     5/78     COMMENTS:
                                   THE FGD SYSTEM CAME BACK ON LINE AFTER THE COAL STRIKE IN LATE MARCH.  IT
                                   IS NOT OPERATING AT FULL LOAD BECAUSE THE NO. 6 BOILER IS STILL OUT AND
                                   SHOULD BE BACK ON LINE IN MID-JULY.  COMPLIANCE TESTS WILL TAKE PLACE IN
                                   JULY, AFTER BOILER 6 IS BACK ON LINE, TO SEE IF THE SYSTEM IS MEETING THE
                                   83% SO2 REMOVAL REQUIREMENT FOR 2% SULFUR COAL.  THERE WERE NO HOURS RE-
                                   PORTED FOR THIS PERIOD BECAUSE OF PRELIMINARY TESTING BEING CONDUCTING IN
                                   PREPARATION FOR THE COMPLIANCE TESTS.  SO FAR, TESTS INDICATE THAT THE SYS
                                   TEM WILL COMPLY WITH THE REQUIRED STANDARDS.  THE AVAILABILITY FOR ALL
                                   FOUR TRAINS WAS BETWEEN 65 AND 75 PERCENT.
             AFFECTED MODULES: SYSTEM

5/78   SYSTEM      70.0
                                                                            744   619
6/78   SYSTEM
                                                                            720   597
       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   6/78     EQUIPMENT: MIST ELIMINATOR
             END DATE     7/78     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                                   THE INTERNAL MIST ELIMINATOR ON MODULE 201 WAS REMOVED AND CLEANED OVER
                                   THE PERIOD.
             AFFECTED MODULES: 201

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   6/78     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     7/78     COMMENTS:
                                   THE FGD SYSTEM HAS ACCUMULATED APPROXIMATELY 24000 HOURS OF OPERATION ON
                                   ALL FOUR MODULES SINCE START-UP.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   6/78     EQUIPMENT: PROCESS CONTROL
             END DATE     7/78     PROBLEM: NOT DEFINED/SPECIFIED
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------------------------------------------PERFORMANCE DATA------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER BOILER   FGD   CAP.
                                                                  SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ----- ----- ------
                          WATER BALANCE PROBLEMS HAVE CONTRIBUTED TO THE OCCURRANCE OF LOW PH, RE-
                          SULTING IN MIST ELIMINATOR PLUGGING.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   6/78      EQUIPMENT: REAGENT HANDLING
             END DATE     7/78      PROBLEM: NOT DEFINED/SPECIFIED
                          THE MIST ELIMINATOR PLUGGING IS ALSO RELATED TO LOW PH RESULTING FROM LIME
                          HANDLING AND SLURRY PREPARATION SYSTEM FAILURE.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   6/78      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     7/78      COMMENTS:
                          THE UTILITY IS CURRENTLY STUDYING WAYS TO TIGHTEN THE WATER BALANCE BY
                          USING THICKENER SUPERNATANT INTERMITTENTLY WITH CLEAR SERVICE WATER FOR TH
                          MIST ELIMINATORS.  THE COMPLIANCE TEST SHOULD TAKE PLACE DURING THE NEXT
                          REPORT PERIOD.
             AFFECTED MODULES: SYSTEM

 7/78  SYSTEM                                                                    744   506

 8/78  SYSTEM                                                                    744   708

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   8/78      EQUIPMENT: MIST ELIMINATOR
             END DATE     9/78      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                          DURING THE AUGUST-SEPTEMBER PERIOD MIST ELIMINATOR CLEANING TOOK PLACE IN
                          ORDER TO CORRECT THE PLUGGING PROBLEM.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   8/78      EQUIPMENT: MIST ELIMINATOR
             END DATE     9/78      PROBLEM: NOT DEFINED/SPECIFIED
                          IN AUGUST THE INTERNAL MIST ELIMINATOR ON MODULE 201 WAS REPLACED.
             AFFECTED MODULES: 201

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   8/78      EQUIPMENT: REAGENT HANDLING
             END DATE     9/78      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                          THE LIME MIXING BASIN HAD TO BE SHUT DOWN OVER A WEEKEND SO THAT EXCESSIVE
                          GRIT AND SOLID PARTICLES THAT HAD BUILT UP COULD BE CLEANED OUT.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   8/78      EQUIPMENT: ABSORBER
             END DATE     9/78      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                          HIGH PRESSURE WATER CLEANING WAS PERFORMED ON MODULES 101 AND 401.
             AFFECTED MODULES: 101    401

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   8/78      EQUIPMENT: ABSORBER
             END DATE     9/78
                          THE RUBBER LINING IN MODULE 101 WAS REPAIRED.
             AFFECTED MODULES: 101

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   8/78      EQUIPMENT: SLUDGE DISPOSAL
             END DATE     9/78      PROBLEM: NOT DEFINED/SPECIFIED
                          A MAJOR PROBLEM AREA DURING THE PERIOD WAS CAUSED BY INSUFFICIENT SUPPLIES
                          OF DRY FLYASH TO MIX WITH THE SLUDGE.  AS A RESULT THE SLUDGE HAS BEEN
                          LEAKING OUT OF THE TRANSPORT TRUCKS WHILE IN TRANSIT TO THE FINAL DISPOSAL
                          SITE.  APPARENTLY NOT ENOUGH FLYASH IS BEING COLLECTED WITH THE PRESENT
                          SYSTEM.
             AFFECTED MODULES: SYSTEM

 9/78  SYSTEM                                                                    720   572
```

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---------------------------------------------PERFORMANCE DATA---------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION % REMOVAL     PER BOILER   FGD   CAP.
                                                                SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------

10/78  SYSTEM                                                               744

11/78  SYSTEM                                                               720

12/78  101                                             91.9
       201                                             88.0
       301                                             27.8
       401                                             87.5
       SYSTEM                                                               744   540

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  12/78     EQUIPMENT: SLUDGE DISPOSAL
             END DATE     1/79     PROBLEM: NOT DEFINED/SPECIFIED
                         DURING THE PERIOD THE LACK OF FLYASH FOR MIXING WITH SLUDGE WAS A PROBLEM
             AFFECTED MODULES: SYSTEM

 1/79  101                                             86.7
       201                                             69.2
       301                                             50.0
       401                                             83.6
       SYSTEM                                                               744   539
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

```
COMPANY NAME                                    GULF POWER
PLANT NAME                                      SCHOLZ
UNIT NUMBER                                     1,2
CITY                                            CHATTAHOOCHEE
STATE                                           FLORIDA
REGULATORY CLASSIFICATION                       C
PARTICULATE EMISSION LIMITATION - NG/J          ******          (****** LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                  ******          (****** LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW                80.0
GROSS UNIT GENERATING CAPACITY - MW               23.0
NET UNIT GENERATING CAPACITY W/FGD - MW           23.0
NET UNIT GENERATING CAPACITY WO/FGD - MW        *******
EQUIVALENT SCRUBBED CAPACITY - MW                 23.0

** BOILER DATA
   SUPPLIER                                     BABCOCK AND WILCOX
   TYPE                                         PULVERIZED COAL, DRY BOTTOM
   SERVICE LOAD                                 BASE
   COMMERCIAL SERVICE DATE                       0/53
   MAXIMUM BOILER FLUE GAS FLOW - CU.M/S        ********        (******* ACFM)
   FLUE GAS TEMPERATURE - C                     *******         (**** F)
   STACK HEIGHT - M                               23.           (  76 FT)
   STACK TOP DIAMETER - M                       *******         (***** FT)

** FUEL DATA
   FUEL TYPE                                    COAL
   FUEL GRADE                                   BITUMINOUS
   AVERAGE HEAT CONTENT - KJ/KG                  29075.         ( 12500 BTU/LB)
   RANGE HEAT CONTENT - BTU/LB                                   ******
   AVERAGE ASH CONTENT - %                        11.00
   RANGE ASH CONTENT - %                        ******
   AVERAGE MOISTURE CONTENT - %                    5.00
   RANGE MOISTURE CONTENT - %                   ******
   AVERAGE SULFUR CONTENT - %                      2.50
   RANGE SULFUR CONTENT - %                     2.5-5.0
   AVERAGE CHLORIDE CONTENT - %                 ********
   RANGE CHLORIDE CONTENT - %                   ******
   FUEL FIRING RATE - M T/H                       34.5          ( 38 TPH)
   FUEL FIRING RATE - MW                        *****

** ESP
   NUMBER                                        2
   TYPE                                         COLD SIDE
   SUPPLIER                                     BUELL
   PARTICULATE DESIGN REMOVAL EFFICIENCY - %      99.5
   FLUE GAS TEMPERATURE - C                      151.7          (  305 F)

** FGD SYSTEM
   SALEABLE PRODUCT/THROWAWAY PRODUCT           SALEABLE PRODUCT
   GENERAL PROCESS TYPE                         WET SCRUBBING
   PROCESS TYPE                                 LIMESTONE (CHIYODA 121)
   SYSTEM SUPPLIER                              CHIYODA INTERNATIONAL
   A-E FIRM                                     CATALYTIC INC.
   DEVELOPMENT LEVEL                            PROTOTYPE
   NEW/RETROFIT                                 RETROFIT
   PARTICULATE DESIGN REMOVAL EFFICIENCY - %      99.50
   SO2 DESIGN REMOVAL EFFICIENCY - %              90.00
   INITIAL START-UP                              8/78

** ABSORBER
   NUMBER                                        1
   TYPE                                         JET BUBBLING REACTOR
   INITIAL START UP                              8/78
   SUPPLIER                                     CHIYODA INTERNATIONAL
   DIMENSIONS                                   24 FT DIA.
   SHELL MATERIAL                               STAINLESS STEEL
   BOILER LOAD/ABSORBER - %                       50.0
   GAS FLOW - CU.M/S                              25.01         (  53000 ACFM)
   PARTICULATE INLET LOAD - G/CU.M                  .1          (  .040 GR/SCF)

** MIST ELIMINATOR
   NUMBER                                        1
   TYPE                                         CHEVRON
   CONFIGURATION                                VERTICAL
   NUMBER OF STAGES                                2
   NUMBER OF PASSES                                2
```

```
                                             SECTION 3
                       DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
-----------------------------------------------------------------------------------------------------

     WASH SYSTEM                                 ONE MINUTE WASH OF FIRST STAGE EVERY TWO WEEKS

 ** WATER LOOP
     TYPE                                        CLOSED

 ** BYPRODUCTS
     BYPRODUCT NATURE                            GYPSUM
     DISPOSITION                                 STACKED IN POND

-------------------------------------------PERFORMANCE DATA------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION   % REMOVAL    PER  BOILER  FGD     CAP.
                                                                 SO2  PART. HOURS HOURS  HOURS  FACTOR
------ ------ ------------ ----------- ----------- -----------   ----- ----- ----- ----- ----- ------

 8/78  SYSTEM                                                                 744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   8/78     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     8/78     COMMENTS:
                          OPERATION BEGAN ON AUGUST 30,1978.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   8/78     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     9/78     COMMENTS:
                          NO INITIAL OPERATIONAL PROBLEMS WERE REPORTED.
             AFFECTED MODULES: SYSTEM

 9/78  SYSTEM                                                                 720

10/78  SYSTEM                                                                 720

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   10/78    EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     11/78    COMMENTS:
                          NO MAJOR OPERATIONAL PROBLEMS WERE REPORTED.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   10/78    EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     10/78    COMMENTS:
                          A 130 HOUR SCHEDULED OUTAGE OCCURRED IN OCTOBER.
             AFFECTED MODULES: SYSTEM

11/78  SYSTEM                                                                 720

12/78  SYSTEM                 100.0                                           744            0

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   12/78    EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     1/79     COMMENTS:
                          THERE HAVE BEEN NO UNPLANNED SHUTDOWNS DURING DECEMBER AND JANUARY.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   12/78    EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     1/79     COMMENTS:
                          THE SYSTEM IS NOW BEING OPERATED IN WHAT IS CALLED PHASE II OF THE TESTING
                          THE SYSTEM IS DELIBERATELY BEING UPSET FROM EQUILIBRIUM (PH, OXIDIZING AIR
                          INPUT, ETC.) TO SEE HOW THE SYSTEM RESPONDS.
             AFFECTED MODULES: SYSTEM

 1/79  SYSTEM                 100.0                                           744            0
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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COMPANY NAME                                     INDIANAPOLIS POWER & LIGHT
PLANT NAME                                       PETERSBURG
UNIT NUMBER                                      3
CITY                                             PETERSBURG
STATE                                            INDIANA
REGULATORY CLASSIFICATION                        A
PARTICULATE EMISSION LIMITATION - NG/J           ******           (****** LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                     516.           ( 1.200 LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW                1180.0
GROSS UNIT GENERATING CAPACITY - MW                532.0
NET UNIT GENERATING CAPACITY W/FGD - MW            515.0
NET UNIT GENERATING CAPACITY WO/FGD - MW           528.0
EQUIVALENT SCRUBBED CAPACITY - MW                  532.0

** BOILER DATA
     SUPPLIER                                    COMBUSTION ENGINEERING
     TYPE                                        PULVERIZED COAL
     SERVICE LOAD                                BASE
     COMMERCIAL SERVICE DATE                      0/77
     MAXIMUM BOILER FLUE GAS FLOW - CU.M/S       ********         (******* ACFM)
     FLUE GAS TEMPERATURE - C                      137.2          ( 279 F)
     STACK HEIGHT - M                              188.           ( 616 FT)
     STACK TOP DIAMETER - M                      *******          (***** FT)

** FUEL DATA
     FUEL TYPE                                   COAL
     FUEL GRADE                                  BITUMINOUS
     AVERAGE HEAT CONTENT - KJ/KG                 25004.          ( 10750 BTU/LB)
     RANGE HEAT CONTENT - BTU/LB                                    ******
     AVERAGE ASH CONTENT - %                     ********
     RANGE ASH CONTENT - %                       9-10
     AVERAGE MOISTURE CONTENT - %                ********
     RANGE MOISTURE CONTENT - %                  10.5-16.5
     AVERAGE SULFUR CONTENT - %                      3.25
     RANGE SULFUR CONTENT - %                    1.5-4.5
     AVERAGE CHLORIDE CONTENT - %                ********
     RANGE CHLORIDE CONTENT - %                  ******
     FUEL FIRING RATE - M T/H                      234.0          (258 TPH)
     FUEL FIRING RATE - MW                         515

** ESP
     NUMBER                                       2
     TYPE                                        COLD SIDE
     SUPPLIER                                    RESEARCH COTTRELL
     PARTICULATE DESIGN REMOVAL EFFICIENCY - %      99.3

** FGD SYSTEM
     SALEABLE PRODUCT/THROWAWAY PRODUCT          THROWAWAY PRODUCT
     GENERAL PROCESS TYPE                        WET SCRUBBING
     PROCESS TYPE                                LIMESTONE
     SYSTEM SUPPLIER                             AIR CORRECTION DIVISION, UOP
     A-E FIRM                                    GIBBS AND HILL
     DEVELOPMENT LEVEL                           FULL-SCALE
     NEW/RETROFIT                                NEW
     PARTICULATE DESIGN REMOVAL EFFICIENCY - %      99.30
     SO2 DESIGN REMOVAL EFFICIENCY - %              85.00
     COMMERCIAL DATE                             12/77
     INITIAL START-UP                            12/77
     CONSTRUCTION COMPLETION                      8/77
     CONSTRUCTION INITIATION                     10/75
     CONTRACT AWARDED                             1/75

** ABSORBER
     NUMBER                                       4
     TYPE                                        TURBULENT CONTACT ABSORBER
     INITIAL START UP                            12/77
     SUPPLIER                                    AIR CORRECTION DIVISION, UOP
     NUMBER OF STAGES                               3
     DIMENSIONS                                  30 X 30 X 100
     SHELL MATERIAL                              CARBON STEEL
     SHELL LINER MATERIAL                        RUBBER
     BOILER LOAD/ABSORBER - %                      25.0
     GAS FLOW - CU.M/S                            176.96          ( 375000 ACFM)
     GAS TEMPERATURE - C                           47.8           (  118 F)
     L/G RATIO - L/CU.M                             6.7           ( 50.0 GAL/1000ACF)
     PRESSURE DROP - KPA                            1.7           ( 7.0 IN-H2O)
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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------------------------------------------------------------------------------------------------------
    SUPERFICAL GAS VELOCITY - M/SEC                 4.4         ( 14.5 FT/S)
    PARTICULATE INLET LOAD - G/CU.M                  .1         (  .025 GR/SCF)
    SO2 INLET CONCENTRATION - PPM                 3400
    SO2 OUTLET CONTRATION - PPM                    385
    SO2 DESIGN REMOVAL EFFICIENCY - %               85.0

 ** FANS
    NUMBER                                         2
    TYPE                                          BOOSTER

 ** MIST ELIMINATOR
    NUMBER                                         8
    CONFIGURATION                                 HORIZONTAL

 ** PUMPS
    SERVICE                                       NUMBER
    -------                                       ------
    RECYCLE                                          8

 ** TANKS
    SERVICE                                       NUMBER
    -------                                       ------
    LIMESTONE SLURRY                              ****
    WASTE SLURRY                                  ****
    RECYCLE                                       ****
    THICKENER OVERFLOW                            ****

 ** REHEATER
    NUMBER                                         4
    TYPE                                          INDIRECT HOT AIR
    HEATING MEDIUM                                STEAM
    TEMPERATURE BOOST - C                            16.7        (   30 F)
    ENERGY REQUIRED                               249 MM BTU/HR.

 ** THICKENER
    NUMBER                                         1
    CONSTRUCTION MATERIAL                         RUBBERLINED CARBON STEEL
    DIAMETER - M                                     50.3        (165 FT)
    OUTLET SOLIDS - %                                35.0

 ** WATER LOOP
    TYPE                                          CLOSED
    FRESH MAKEUP WATER ADDITION - LITERS/S           55.6        (  882 GPM)

 ** REAGENT PREPARATION EQUIPMENT
    NUMBER OF BALL MILLS                             1
    BALL MILL CAPACITY- M T/H                       38.1         ( 42.0 TPH)

 ** TREATMENT
    CONTRACTOR                                    IUCS

 ** DISPOSAL
    NATURE                                        FINAL
    TYPE                                          UNLINED POND
    LOCATION                                      ON-SITE
    TRANSPORTATION                                TRUCK


-----------------------------------------PERFORMANCE DATA---------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

12/77  SYSTEM                                                               744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/77     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    12/77     COMMENTS:
                      OPERATION OF ALL FOUR MODULES COMMENCED DURING DECEMBER.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/77     EQUIPMENT: AGITATOR
            END DATE    12/77     PROBLEM: NOT DEFINED/SPECIFIED
```

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------------------------------------------------------------------------------------------------------------
----------------------------------------------PERFORMANCE DATA----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                         REPAIRS TO THE RECYCLE TANK AGITATOR WERE REQUIRED.
         AFFECTED MODULES: A

 1/78  SYSTEM                                                               744

     ** PROBLEMS/SOLUTIONS/COMMENTS
         START DATE   1/78      EQUIPMENT: BOILER-RELATED
         END DATE     4/78      PROBLEM: NOT DEFINED/SPECIFIED
                         PROBLEMS WERE ENCOUNTERED WITH THE FLYASH HANDLING SYSTEM FORCING FGD
                         SHUTDOWN.  THE UNIT WAS RESTATED IN THE MIDDLE OF APRIL.
         AFFECTED MODULES: SYSTEM

 2/78  SYSTEM                                                               672

     ** PROBLEMS/SOLUTIONS/COMMENTS
         START DATE   2/78      EQUIPMENT: PIPING
         END DATE     2/78      PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                         PIPE FREEZE-UP DAMAGE WAS REPAIRED.
         AFFECTED MODULES: SYSTEM

 3/78  SYSTEM                                                               744

     ** PROBLEMS/SOLUTIONS/COMMENTS
         START DATE   3/78      EQUIPMENT: FGD SYSTEM, GENERAL
         END DATE     3/78      COMMENTS:
                         INSULATION WAS INSTALLED DURING THE SYSTEM OUTAGE.
         AFFECTED MODULES: SYSTEM

     ** PROBLEMS/SOLUTIONS/COMMENTS
         START DATE   3/78      EQUIPMENT: THICKENER
         END DATE     3/78      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                         A BROKEN PINION GEAR WAS REPAIRED DURING THE SYSTEM OUTAGE.
         AFFECTED MODULES: SYSTEM

     ** PROBLEMS/SOLUTIONS/COMMENTS
         START DATE   3/78      EQUIPMENT: INSTRUMENTATION
         END DATE     3/78      COMMENT: PREVENTIVE MAINTENANCE
                         INSTRUMENTATION MAINTENANCE PERFORMED DURING THE SYSTEM OUTAGE.
         AFFECTED MODULES: SYSTEM

 4/78  SYSTEM                                                               720

     ** PROBLEMS/SOLUTIONS/COMMENTS
         START DATE   4/78      EQUIPMENT: VALVES
         END DATE     5/78      PROBLEM: NOT DEFINED/SPECIFIED
                         ALL CONTROL VALVES WERE RETURNED TO THE FACTORY FOR MODIFICATIONS.
         AFFECTED MODULES: SYSTEM

 5/78  SYSTEM                                                               744

     ** PROBLEMS/SOLUTIONS/COMMENTS
         START DATE   5/78      EQUIPMENT: BOILER-RELATED
         END DATE     6/78      PROBLEM: NOT DEFINED/SPECIFIED
                         THE MAIN POWER TRANSFORMER FAULTED CAUSING THE SYSTEM TO SHUTDOWN.
         AFFECTED MODULES: SYSTEM

 6/78  SYSTEM                                                               720

 7/78  SYSTEM                                                               744

 8/78  SYSTEM                                                               744

     ** PROBLEMS/SOLUTIONS/COMMENTS
         START DATE   8/78      EQUIPMENT: PROCESS CONTROL
         END DATE     9/78
                         PROBLEMS HAVE BEEN EXPERIENCED WITH CONTROLS.
         AFFECTED MODULES: SYSTEM
```

```
----------------------------------------PERFORMANCE DATA------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   8/78      EQUIPMENT: PIPING
             END DATE    10/78
                           PROBLEMS HAVE BEEN EXPERIENCED WITH CONTROLS.
                           CRACKING PROBLEMS HAVE BEEN EXPERIENCED WITH FIBERGLASS PIPING.  THE PROB-
                           LEM WAS SOLVED BY REPLACING SECTIONS WITH RUBBER LINED STEEL PIPING, NEW
                           FRP PIPING, AND PROVIDING ADDITIONAL PIPE SUPPORTS.
             AFFECTED MODULES: SYSTEM

 9/78  SYSTEM                                                                720

10/78  SYSTEM                                                                744

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/78      EQUIPMENT: GAS DAMPER
             END DATE    10/78      PROBLEM: NOT DEFINED/SPECIFIED
                           BYPASS DAMPER PROBLEMS WERE EXPERIENCED.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/78      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    10/78      COMMENTS:
                           AN SO2 COMPLIANCE TEST WAS INVALID DUE TO BYPASS DAMPER PROBLEMS.
             AFFECTED MODULES: SYSTEM

11/78  SYSTEM                                                                720

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  11/78      EQUIPMENT: REAGENT HANDLING
             END DATE    11/78      PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                          FREEZE-UPS IN THE LIME DELIVERY SYSTEM WERE EXPERIENCED
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  11/78      EQUIPMENT: INSTRUMENTATION
             END DATE    11/78      PROBLEM: NOT DEFINED/SPECIFIED
                          AN INSTRUMENTATION POWER TRANSFORMER FAILURE CAUSED ABOUT 6 DAYS OUTAGE.
             AFFECTED MODULES: SYSTEM

12/78  SYSTEM                                                                744

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  12/78      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     1/79      COMMENTS:
                           OPERATIONAL HOURS ARE NOT YET AVAILABLE.  THE UTILITY REPORTED THAT THE
                           SYSTEM HAS NOT YET BEEN ACCEPTED.
             AFFECTED MODULES: SYSTEM

 1/79  SYSTEM                                                                744
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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COMPANY NAME                                   KANSAS CITY POWER & LIGHT
PLANT NAME                                     HAWTHORN
UNIT NUMBER                                    3
CITY                                           KANSAS CITY
STATE                                          MISSOURI
REGULATORY CLASSIFICATION                      B
PARTICULATE EMISSION LIMITATION - NG/J           82.         (  .190 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                 ******        (****** LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW              836.0
GROSS UNIT GENERATING CAPACITY - MW             110.0
NET UNIT GENERATING CAPACITY W/FGD - MW          98.0
NET UNIT GENERATING CAPACITY WO/FGD - MW        100.0
EQUIVALENT SCRUBBED CAPACITY - MW               110.0

** BOILER DATA
    SUPPLIER                                   COMBUSTION ENGINEERING
    TYPE                                       DRY BOTTOM, PULVERIZED-COAL
    SERVICE LOAD                               CYCLIC
    COMMERCIAL SERVICE DATE                     0/53
    MAXIMUM BOILER FLUE GAS FLOW - CU.M/S        235.95      ( 500000 ACFM)
    FLUE GAS TEMPERATURE - C                     148.9       ( 300 F)
    STACK HEIGHT - M                              61.        ( 200 FT)
    STACK TOP DIAMETER - M                     ********      (***** FT)

** FUEL DATA
    FUEL TYPE                                  COAL
    FUEL GRADE                                 BITUMINOUS
    AVERAGE HEAT CONTENT - KJ/KG                22795.       (  9800 BTU/LB)
    RANGE HEAT CONTENT - BTU/LB                                 ******
    AVERAGE ASH CONTENT - %                       11.00
    RANGE ASH CONTENT - %                      ******
    AVERAGE MOISTURE CONTENT - %               ********
    RANGE MOISTURE CONTENT - %                 ******
    AVERAGE SULFUR CONTENT - %                      .60
    RANGE SULFUR CONTENT - %                   ******
    AVERAGE CHLORIDE CONTENT - %               ********
    RANGE CHLORIDE CONTENT - %                 ******
    FUEL FIRING RATE - M T/H                      45.3       ( 50 TPH)
    FUEL FIRING RATE - MW                      *****

** FUEL DATA
    FUEL TYPE                                  COAL
    FUEL GRADE                                 BITUMINOUS
    AVERAGE HEAT CONTENT - KJ/KG                26516.       ( 11400 BTU/LB)
    RANGE HEAT CONTENT - BTU/LB                                 ******
    AVERAGE ASH CONTENT - %                       14.00
    RANGE ASH CONTENT - %                      ******
    AVERAGE MOISTURE CONTENT - %               ********
    RANGE MOISTURE CONTENT - %                 ******
    AVERAGE SULFUR CONTENT - %                     3.00
    RANGE SULFUR CONTENT - %                   ******
    AVERAGE CHLORIDE CONTENT - %               ********
    RANGE CHLORIDE CONTENT - %                 ******
    FUEL FIRING RATE - M T/H                      45.3       ( 50 TPH)
    FUEL FIRING RATE - MW                      *****

** FGD SYSTEM
    SALEABLE PRODUCT/THROWAWAY PRODUCT         THROWAWAY PRODUCT
    GENERAL PROCESS TYPE                       WET SCRUBBING
    PROCESS TYPE                               LIME
    SYSTEM SUPPLIER                            COMBUSTION ENGINEERING
    A-E FIRM                                   BLACK AND VEACH
    DEVELOPMENT LEVEL                          FULL-SCALE
    NEW/RETROFIT                               RETROFIT
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %     99.00
    SO2 DESIGN REMOVAL EFFICIENCY - %             70.00
    INITIAL START-UP                           11/72

** ABSORBER
    NUMBER                                      2
    TYPE                                       MARBLE BED
    INITIAL START UP                           11/72
    SUPPLIER                                   COMBUSTION ENGINEERING
    DIMENSIONS                                 18 X 26 X 56
    SHELL MATERIAL                             CARBON STEEL
    SHELL LINER MATERIAL                       CEILCOTE
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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------------------------------------------------------------------------------------------------------------------------
     INTERNAL MATERIAL                                  316L SS
     NUMBER OF NOZZLES                                     63
     PRESSURE DROP - KPA                                  3.2          (13.0 IN-H2O)
     SUPERFICAL GAS VELOCITY - M/SEC                      3.0          ( 10.0 FT/S)

 ** FANS
     TYPE                                               SCRUBBER I.D.

 ** MIST ELIMINATOR
     NUMBER                                              2
     TYPE                                               CHEVRON
     CONSTRUCTION MATERIAL                              FIBERGLASS
     CONFIGURATION                                      HORIZONTAL
     NUMBER OF PASSES                                      2
     FREEBOARD DISTANCE - M                               3.05         (10.0 FT)
     DEPTH - M                                             .18         (  .6 FT)
     VANE SPACING - CM                                    7.6          ( 3.00 IN)
     VANE ANGLES                                        45 DEG.
     WASH SYSTEM                                        EIGHT WASH LANCES; CLARIFIED AND MAKE-UP WATER
     PRESSURE DROP - KPA                                   .4          ( 1.5 IN-H2O)

 ** PROCESS CONTROL CHEMISTRY
     CONTROL VARIABLES                                  PH
     CONTROL RANGE                                      4.5-6.5

 ** TANKS
     SERVICE                                            NUMBER
     -------                                            ------
     SO2 SCRUBBER TOWER HOLDUP                          ****

 ** REHEATER
     TYPE                                               IN-LINE
     HEATING MEDIUM                                     HOT WATER 325F, 150 PSIG

 ** THICKENER
     NUMBER                                               1
     DIAMETER - M                                        35.1          (115 FT)

 ** WATER LOOP
     TYPE                                               CLOSED

 ** REAGENT PREPARATION EQUIPMENT
     NUMBER OF SLAKERS                                    1
     SLAKER CAPACITY - M T/H                             51.7          ( 57.0 TPH)

 ** TREATMENT
     TYPE                                               SOME STABILIZATION FROM FLYASH
     SUPPLIER                                           NONPROPRIETARY

 ** DISPOSAL
     NATURE                                             FINAL
     TYPE                                               UNLINED POND
     LOCATION                                           ON-SITE
     AREA - ACRES                                         160.0
     CAPACITY - CU.M                                     3130880       ( 2560.0 ACRE-FT)


----------------------------------------PERFORMANCE DATA-----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------

 7/75   3A
        3B                    42.0
        SYSTEM                                                                  744    584

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    7/75      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE      7/75      COMMENTS:
                       A-MODULE ENCOUNTERED A LEAK IN THE CITY WATER LINE.
             AFFECTED MODULES: 3A

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    7/75      EQUIPMENT: DUCTWORK
             END DATE      7/75      PROBLEM: CHEMICAL-RELATED PLUGGING
```

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-------------------------------------------PERFORMANCE DATA-----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                          THE DUCT TO THE I.D. FAN BECAME PLUGGED.
             AFFECTED MODULES: 3A

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   7/75      EQUIPMENT: GAS DAMPER
             END DATE     7/75      PROBLEM: MECHANICAL-RELATED COMPONENT INEFFICIENCY
                          AN OUTLET DAMPER IN MODULE A MALFUNCTIONED.
             AFFECTED MODULES: 3A

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   7/75      EQUIPMENT: ABSORBER
             END DATE     7/75      PROBLEM: NOT DEFINED/SPECIFIED
                          MARBLES WERE LOST FROM THE BED IN MODULE B.
             AFFECTED MODULES: 3B

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   7/75      EQUIPMENT: PIPING
             END DATE     7/75      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                          A SPRAY HEADER WAS BROKEN IN MODULE B.
             AFFECTED MODULES: 3B

 8/75  3A
       3B
       SYSTEM                                                               744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   8/75      EQUIPMENT: FAN
             END DATE     8/75      PROBLEM: NOT DEFINED/SPECIFIED
                          THE I.D. FAN FOR HALF THE BOILER WAS LOST.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   8/75      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     8/75      COMMENTS:
                          THE PROBLEMS ENCOUNTERED IN JULY CONTINUED INTO AUGUST.
             AFFECTED MODULES: SYSTEM

 9/75  3A                      69.0
       3B                      23.0
       SYSTEM                                                               720    358

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   9/75      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     9/75      COMMENTS:
                          OUTAGE DUE TO CLEANING AND MECHANICAL REPAIRS. POTS, COVERS,AND MARBLES IN
                          THE MARBLE BED OF MODULE 3B WERE REPLACED.
             AFFECTED MODULES: SYSTEM

10/75  3A                      65.0
       3B                      81.0
       SYSTEM                                                               744    180

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/75      EQUIPMENT: RECYCLE PUMP
             END DATE    10/75      PROBLEM: NOT DEFINED/SPECIFIED
                          MODULE 3A OUTAGE WAS DUE LARGELY TO REPLACEMENT OF A RECYCLE PUMP MOTOR.
             AFFECTED MODULES: 3A

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/75      EQUIPMENT: BOILER-RELATED
             END DATE    10/75      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                          A SCHEDULED BOILER OVERHAUL REDUCED BOILER OPERATION HOURS.
             AFFECTED MODULES: SYSTEM

11/75  3A
       3B
       SYSTEM                                                               720
```

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-----------------------------------------------------------------------------------------------------

---------------------------------------PERFORMANCE DATA----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION % REMOVAL   PER BOILER   FGD   CAP.
                                                               SO2   PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  11/75      EQUIPMENT: BOILER-RELATED
             END DATE    1/76       COMMENTS:
                         BOILERS AND SCRUBBERS WERE SHUT DOWN FOR A SCHEDULED TURBINE OVERHAUL. THE
                         SYSTEM IS SCHEDULED TO GO BACK ON-LINE IN JANUARY 1976. SYSTEM WAS DOWN
                         ALL MONTH BECAUSE OF FROZEN EQUIPMENT AND LINE AND A MANPOWER SHORTAGE
                         TO A BOILER AND TURBINE OVERHAUL ON ANOTHER UNIT AT THIS STATION.
             AFFECTED MODULES: SYSTEM

12/75  3A
       3B
       SYSTEM                                                                    744

 1/76  3A
       3B
       SYSTEM                                                                    744

 2/76  3A                        37.0
       3B                         1.0
       SYSTEM                                                                    696   503

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  2/76       EQUIPMENT: SCRUBBER
             END DATE    2/76       PROBLEM: CHEMICAL-RELATED PLUGGING
                         SCRUBBER OUTAGES RESULTED FROM PLUGGING IN THE SCRUBBER BED, CAUSED BY
                         CONVERSION FROM AN UNDER-BED TO OVER-BED SPRAY SYSTEM.
             AFFECTED MODULES: SYSTEM

 3/76  3A
       3B
       SYSTEM                                                                    744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  3/76       EQUIPMENT: SCRUBBER
             END DATE    4/76       COMMENTS:
                         RECONVERSION OF MODULE 3B"S SPRAY SYSTEM TO AN UNDER-BED CONFIGURATION HAS
                         BEEN COMPLETED.
             AFFECTED MODULES: 3B

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  3/76       EQUIPMENT: GAS DAMPER
             END DATE    4/76       COMMENTS:
                         THE BYPASS SYSTEM HAS BEEN MODIFIED AND CHANGED TO A SLIDE-GATE DAMPER
                         ARRANGEMENT.
             AFFECTED MODULES: 3B

 4/76  3A
       3B
       SYSTEM                                                                    720

 5/76  3A
       3B
       SYSTEM                                                                    744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  5/76       EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    5/76       COMMENTS:
                         THE SYSTEM WAS SHUT DOWN DURING THE MONTH DUE TO THE CONTINUATION OF MAN-
                         POWER SHORTAGE PROBLEMS. THE UTILITY DID PERFORM SOME CLEANING AND REPAIRS
                         DURING THE MONTH.
             AFFECTED MODULES: SYSTEM

 6/76  3A                        39.0
       3B                        44.0
       SYSTEM                                                                    720   505
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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---------------------------------------------PERFORMANCE DATA---------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS  HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   6/76      EQUIPMENT: MIST ELIMINATOR
              END DATE     6/76      PROBLEM: NOT DEFINED/SPECIFIED
                           THE UTILITY IS IN THE PROCESS OF MODIFYING THE DEMISTER WASH SYSTEM ON
                           BOTH UNITS 3 AND 4. THE WATER LANCES ARE BEING CHANGED FROM FRP TO CARBON
                           STEEL TO ATTEMPT TO PREVENT THE LOSS OF THE NOZZLES AND THE SUBSEQUENT
                           SHATTERING OF THE LANCES.
              AFFECTED MODULES: SYSTEM

  7/76  SYSTEM                                                                 744

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   7/76      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     8/76      COMMENTS:
                           THE UTILITY IS PRESENTLY CONVERTING THIS SYSTEM FROM LIMESTONE INJECTION
                           AND TAIL END SCRUBBING TO A LIME SLURRY BASED SCRUBBING SYSTEM.
              AFFECTED MODULES: SYSTEM

  8/76  SYSTEM                                                                 744

  9/76  SYSTEM                                                                 720

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   9/76      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE    10/76      COMMENTS:
                           THE SYSTEM WAS VIRTUALLY OUT OF SERVICE THE ENTIRE REPORT PERIOD. MANPOWER
                           COMMITMENTS WERE SERIOUSLY HAMPERED BY A MAJOR EXPLOSION WHICH OCCURRED IN
                           THE COAL MILL PULVERIZING AREA OF HAWTHORN NO. 5.
              AFFECTED MODULES: SYSTEM

 10/76  SYSTEM                                                                 744

 11/76  3A
        3B
        SYSTEM                                                                 720

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  11/76      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE    12/76      COMMENTS:
                           THE UNIT DID NOT OPERATE BECAUSE OF THE ONGOING MAJOR MODIFICATIONS BEING
                           IMPLEMENTED ON THE SCRUBBING SYSTEM. THE SYSTEM SHOULD BE READY FOR OPERA-
                           TION FEB 1. THE UNIT MUST UNDERGO A SERIES OF TESTS TO INSURE COMPLIANCE
                           WITH CITY AND FEDERAL REGULATIONS.
              AFFECTED MODULES: SYSTEM

 12/76  3A
        3B
        SYSTEM                                                                 744

  1/77  3A
        3B
        SYSTEM                                                                 744

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   1/77      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     3/77      COMMENTS:
                          UNIT NO. 3 WAS DOWN FOR THE ENTIRE MONTH OF JANUARY FOR THE COMPLETION OF
                           MONDIFICATIONS AND REPAIRS ON THE SCRUBBERS AND BOILER. THE UNIT BECAME
                           AVAILABLE FOR SERVICE AND TESTING ON FEB 7.THE UNIT'S MEASURED PARTICULATE
                           EMISSIONS AT THE SCRUBBER OUTLET WAS 0.12 LB/MM BTU (WELL BELOW THE
                           REQUIRED 0.17 LB/MM BTU) BURNING APPROXIMATELY 2.0 % SULFUR COAL. THE
                           CONVERSION FROM LIMESTONE TO LIME HAS GONE SMOOTHLY. SOME INITIAL PROBLEMS
                           WITH PROCESS CHEMISTRY CONTROL HAVE BEEN CORRECTED. OTHER MINOR PROBLEMS
                           INCLUDED PUMP MALFUNCTIONS AND LOSS OF SLAKING WATER PRESSURE. SYSTEM
                           OPERATIONS ARE CONTINUING AT 0% SOLIDS AND 100% BLOWDOWN WITH A FRESH
                          WATER MAKE-UP OF APPROXIMATELY 7.0 GPM/MW.
```

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-------------------------------------------PERFORMANCE DATA-----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER BOILER  FGD   CAP.
                                                               SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ---- ----- ----- ----- ----- ------
             AFFECTED MODULES: SYSTEM

2/77   3A                       88.0
       3B                       69.0
       SYSTEM                                                   .00         672  383

3/77   3A                       99.0
       3B                       85.0
       SYSTEM                                                               744  482

4/77   3A                       57.0
       3B                       57.0
       SYSTEM                                                               720  720

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   4/77     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     5/77     COMMENTS:
                         THE SYSTEM IS NOW OPERATING AT ABOUT 15-25 PERCENT BLOWDOWN.THE PH CONTROL
                         SYSTEM OPERATIONS HAVE BEEN EXCELLENT,DURING MAY THE BOILER BURNED GAS FOR
                         216 HOURS (NOT INCLUDED IN OPERABILITY FIGURES). SO2 REMOVAL EFFICIENCY IS
                         ESTIMATED AT 50-60 PERCENT FOR BOTH MODULES,ALTHOUGH ACTUAL TESTS HAVE NOT
                         BEEN RUN FOR ABOUT A YEAR AND A HALF. BOTH MODULES ARE CURRENTLY OPERATING
                         SIMULTANEOUSLY.
             AFFECTED MODULES: SYSTEM

5/77   3A                       58.0
       3B                       58.0
       SYSTEM                                                               744  736

6/77   SYSTEM                                                               720  720

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   6/77     EQUIPMENT: BOILER-RELATED
             END DATE     6/77     COMMENTS:
                         THE UNIT FIRED NATURAL GAS THROUGHOUT THE MONTH WITH THE EXCEPTION OF A
                         72-HOUR PERIOD DURING WHICH COAL WAS FIRED AND THE SCRUBBERS WERE OPERATED
                         FOR SCRUBBER PERSONNEL PURPOSES ONLY.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   7/77     EQUIPMENT: BOILER-RELATED
             END DATE     9/77     COMMENTS:
                         THE UNIT FIRED NATURAL GAS FOR THE ENTIRE PERIOD,MAKING SCRUBBER OPERATION
                         UNNECESSARY.
             AFFECTED MODULES: SYSTEM

7/77   3A                       10.0
       3B                       10.0
       SYSTEM                                                               744  744

8/77   SYSTEM                                                               744

9/77   SYSTEM                                                               720

10/77  SYSTEM                                                               744  744     0

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   10/77    EQUIPMENT: BOILER-RELATED
             END DATE     11/77    COMMENTS:
                         THE UNIT WAS SHUT DOWN BECAUSE OF A LACK OF NATURAL GAS UNTIL NOVEMBER 3,
                         WHEN IT BEGAN FIRING COAL. (NOTE:THE BOILER AND FGD SYSTEM MUST RUN SIMUL-
                         TANEOUSLY BECAUSE NO BYPASS IS ALLOWED EXCEPT DURING EMERGENCIES. WHENEVER
                         THE BOILER IS DOWN, THE SCRUBBER IS EFFECTIVELY UNAVAILABLE BECAUSE THE
                         DOWN TIME IS UTILIZED FOR SCRUBBER MAINTENANCE AND REPAIR, MAKING AVAILA-
                         BILITY AND UTILIZATION FACTORS IDENTICAL FOR THIS SYSTEM.
             AFFECTED MODULES: SYSTEM
```

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---------------------------------------------PERFORMANCE DATA---------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL    PER  BOILER  FGD   CAP.
                                                                 SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/77     EQUIPMENT: ABSORBER
             END DATE    11/77     PROBLEM: NOT DEFINED/SPECIFIED
                          DURING BOILER DOWN TIME,THE REACTION TANKS AND SPRAY HEADERS WERE REPLACED
                          BY STAINLESS STEEL COMPONENTS; THE INTERCONNECTING PIPING IS RUBBER LINED.
             AFFECTED MODULES: SYSTEM

11/77  SYSTEM      57.0                                                     720   720   4110

12/77  SYSTEM      47.0                                                     744   744   3460

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  12/77     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     1/78     COMMENT: PREVENTIVE MAINTENANCE
                          THE FGD MODULES WERE CLEANED DURING BOILER OUTAGES (THERE WERE NO FGD-
                          RELATED OUTAGES).
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  12/77     EQUIPMENT: PIPING
             END DATE     1/78     PROBLEM: MECHANICAL-RELATED COMPONENT INEFFICIENCY
                          SOME LEAKS IN THE FGD PIPING WERE REPLACED.
             AFFECTED MODULES: SYSTEM

 1/78  SYSTEM                                                               744   744

 2/78  SYSTEM      30.0                                                     672   672   1980

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   2/78     EQUIPMENT: BOILER-RELATED
             END DATE     3/78     PROBLEM: CHEMICAL-RELATED EROSION
                          DURING FEBRUARY THE UNIT WAS DOWN FOUR TIMES WITH ECONOMIZER AND WATER
                          WALL LEAKS(504 HOURS TOTAL). WATER WALL LEAK REPAIR AS WELL AS ACID
                          CLEANING OF THE BOILER CAUSED ADDITIONAL OUTAGE TIME DURING THE LAST WEEK
                          OF MARCH.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   2/78     EQUIPMENT: BOILER-RELATED
             END DATE     3/78     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                          A TWO WEEK OUTAGE WAS SCHEDULED DURING MARCH FOR SEASONAL MAINTENANCE.
             AFFECTED MODULES: SYSTEM

 3/78  SYSTEM      63.0                                                     744   744   4710

 4/78  SYSTEM                                           44.0                720   720   3270

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   4/78     EQUIPMENT: DUCTWORK
             END DATE     5/78     PROBLEM: NOT DEFINED/SPECIFIED
                          AN AIR PREHEATER FIRE DISCOVERED ON MAY 12 CAUSED DAMAGES THAT FORCED
                          MODULE A TO BE DOWN THE REST OF THE MONTH.
             AFFECTED MODULES: 3A

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   6/78     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     7/78     COMMENTS:
                          NO INFORMATION WAS AVAILABLE FOR THE JUNE-JULY REPORT PERIOD DUE TO A PLAN
                          STRIKE.
             AFFECTED MODULES: SYSTEM

 5/78  SYSTEM                                                               744   744

 6/78  SYSTEM                                                               720

 7/78  SYSTEM                                                               744
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---------------------------------------------PERFORMANCE DATA--------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                 SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------

 8/78  SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     9/78      COMMENTS:
                         THE SCRUBBING SYSTEM IS OPERATING EVEN THOUGH THE UTILITY IS STILL IN THE
                         MIDST OF A STRIKE. FGD PERFORMANCE FIGURES ARE NOT AVAILABLE SINCE THE
                         UTILITY IS NOT RECORDING FGD SYSTEM OPERATING HOURS DURING THE STRIKE.
            AFFECTED MODULES: SYSTEM

 9/78  SYSTEM                                                                720

10/78  SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    11/78      COMMENTS:
                         ALTHOUGH THE STRIKE IS OVER NO OPERATIONAL DATA IS AVAILABLE.  THE FGD
                         SYSTEM IS IN OPERATION.
            AFFECTED MODULES: SYS*

11/78  SYSTEM                                                                720

12/78  SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     1/79      COMMENTS:
                         HOURS OF OPERATION ARE STILL NOT AVAILABLE.  THE FGD SYSTEM IS IN OPERATIO
                         BUT AT PRESENT PERSONNEL ARE BEING REASSIGNED PREVENTING ACCURATE DATA
                         RECORDING.
            AFFECTED MODULES: SYS*

 1/79  SYSTEM                                                                744
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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COMPANY NAME                                    KANSAS CITY POWER & LIGHT
PLANT NAME                                      HAWTHORN
UNIT NUMBER                                     4
CITY                                            KANSAS CITY
STATE                                           MISSOURI
REGULATORY CLASSIFICATION                       B
PARTICULATE EMISSION LIMITATION - NG/J            82.        (  .190 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                  ******       (****** LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW               836.0
GROSS UNIT GENERATING CAPACITY - MW              110.0
NET UNIT GENERATING CAPACITY W/FGD - MW           98.0
NET UNIT GENERATING CAPACITY WO/FGD - MW         100.0
EQUIVALENT SCRUBBED CAPACITY - MW                110.0

** BOILER DATA
     SUPPLIER                                   COMBUSTION ENGINEERING
     TYPE                                       DRY BOTTOM, PULVERIZED-COAL
     SERVICE LOAD                               CYCLIC
     COMMERCIAL SERVICE DATE                     0/55
     MAXIMUM BOILER FLUE GAS FLOW - CU.M/S        235.95      ( 500000 ACFM)
     FLUE GAS TEMPERATURE - C                     148.9       ( 300 F)
     STACK HEIGHT - M                              61.        ( 200 FT)
     STACK TOP DIAMETER - M                     *******       (***** FT)

** FUEL DATA
     FUEL TYPE                                  COAL
     FUEL GRADE                                 BITUMINOUS
     AVERAGE HEAT CONTENT - KJ/KG                22795.       (  9800 BTU/LB)
     RANGE HEAT CONTENT - BTU/LB                               ******
     AVERAGE ASH CONTENT - %                        11.00
     RANGE ASH CONTENT - %                      ******
     AVERAGE MOISTURE CONTENT - %               ********
     RANGE MOISTURE CONTENT - %                 ******
     AVERAGE SULFUR CONTENT - %                       .60
     RANGE SULFUR CONTENT - %                   ******
     AVERAGE CHLORIDE CONTENT - %               ********
     RANGE CHLORIDE CONTENT - %                 ******
     FUEL FIRING RATE - M T/H                      45.3        ( 50 TPH)
     FUEL FIRING RATE - MW                      *****

** FUEL DATA
     FUEL TYPE                                  COAL
     FUEL GRADE                                 BITUMINOUS
     AVERAGE HEAT CONTENT - KJ/KG                26516.       ( 11400 BTU/LB)
     RANGE HEAT CONTENT - BTU/LB                               ******
     AVERAGE ASH CONTENT - %                        14.00
     RANGE ASH CONTENT - %                      ******
     AVERAGE MOISTURE CONTENT - %               ********
     RANGE MOISTURE CONTENT - %                 ******
     AVERAGE SULFUR CONTENT - %                      3.00
     RANGE SULFUR CONTENT - %                   ******
     AVERAGE CHLORIDE CONTENT - %               ********
     RANGE CHLORIDE CONTENT - %                 ******
     FUEL FIRING RATE - M T/H                      45.3        ( 50 TPH)
     FUEL FIRING RATE - MW                      *****

** FGD SYSTEM
     SALEABLE PRODUCT/THROWAWAY PRODUCT         THROWAWAY PRODUCT
     GENERAL PROCESS TYPE                       WET SCRUBBING
     PROCESS TYPE                               LIME
     SYSTEM SUPPLIER                            COMBUSTION ENGINEERING
     A-E FIRM                                   BLACK AND VEACH
     DEVELOPMENT LEVEL                          FULL-SCALE
     NEW/RETROFIT                               RETROFIT
     PARTICULATE DESIGN REMOVAL EFFICIENCY - %     99.00
     SO2 DESIGN REMOVAL EFFICIENCY - %             70.00
     INITIAL START-UP                            8/72

** ABSORBER
     NUMBER                                     2
     TYPE                                       MARBLE BED
     INITIAL START UP                            8/72
     SUPPLIER                                   COMBUSTION ENGINEERING
     DIMENSIONS                                 18 X 26 X 56
     SHELL MATERIAL                             CARBON STEEL
     SHELL LINER MATERIAL                       CEILCOTE
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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        INTERNAL MATERIAL                              316L SS
        NUMBER OF NOZZLES                                63
        PRESSURE DROP - KPA                               3.2       (13.0 IN-H2O)
        SUPERFICAL GAS VELOCITY - M/SEC                   3.0       ( 10.0 FT/S)

   ** FANS
        TYPE                                           SCRUBBER I.D.

   ** MIST ELIMINATOR
        NUMBER                                          2
        TYPE                                           CHEVRON
        CONSTRUCTION MATERIAL                          FIBERGLASS
        CONFIGURATION                                  HORIZONTAL
        NUMBER OF PASSES                                  2
        FREEBOARD DISTANCE - M                            3.05      (10.0 FT)
        DEPTH - M                                          .18      (  .6 FT)
        VANE SPACING - CM                                 7.6       ( 3.00 IN)
        VANE ANGLES                                    45 DEG.
        WASH SYSTEM                                    EIGHT WASH LANCES; CLARIFIED AND MAKE-UP WATER
        PRESSURE DROP - KPA                                .4       ( 1.5 IN-H2O)

   ** PROCESS CONTROL CHEMISTRY
        CONTROL VARIABLES                              PH
        CONTROL RANGE                                  4.5-6.5

   ** TANKS
        SERVICE                                        NUMBER
        -------                                        ------
        SO2 SCRUBBER TOWER HOLDUP                      ****

   ** REHEATER
        TYPE                                           IN-LINE
        HEATING MEDIUM                                 HOT WATER 325F, 150 PSIG

   ** THICKENER
        NUMBER                                          1
        DIAMETER - M                                     35.1         (115 FT)

   ** WATER LOOP
        TYPE                                           CLOSED

   ** REAGENT PREPARATION EQUIPMENT
        NUMBER OF SLAKERS                                 1
        SLAKER CAPACITY - M T/H                          51.7         ( 57.0 TPH)

   ** TREATMENT
        TYPE                                           SOME STABILIZATION FROM FLYASH
        SUPPLIER                                       NONPROPRIETARY

   ** DISPOSAL
        NATURE                                         FINAL
        TYPE                                           UNLINED POND
        LOCATION                                       ON-SITE
        AREA - ACRES                                     160.0
        CAPACITY - CU.M                                   3130880     (  2560.0 ACRE-FT)


----------------------------------------PERFORMANCE DATA------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------

 7/75  4A                       8.0
       4B                      25.0
       SYSTEM                                                                 744    518

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    7/75     EQUIPMENT: ABSORBER
            END DATE      7/75     PROBLEM: CHEMICAL-RELATED PLUGGING
                          BOTH MODULES ENCOUNTERED MARBLE BED PLUGGING AND STRAINER PROBLEMS.
            AFFECTED MODULES: SYSTEM

 8/75  4A
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-----------------------------------------PERFORMANCE DATA------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION % REMOVAL    PER BOILER  FGD   CAP.
                                                               SO2   PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
       4B
       SYSTEM                                                               744

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   8/75      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE     8/75      COMMENTS:
                        A NEW PROCESS CHEMISTRY IS BEING TRIED- ATTEMPTING TO RUN AT 100% BLOWDOWN
                        AND NEAR ZERO PERCENT SOLIDS WITH PH BEING MAINTAINED AT 5 WITHOUT LIME
                        STONE INJECTION. EMPHASIS IS BEING PLACED ON PARTICULATE CONTROL.
           AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   8/75      EQUIPMENT: FAN
           END DATE     8/75      PROBLEM: NOT DEFINED/SPECIFIED
                        LOST HALF OF BOILER TO I.D. FAN OUTAGE CAUSING BOTH FGD MODULES TO BE SHUT
                        DOWN TO PREVENT LOSS OF THE ENTIRE UNIT.
           AFFECTED MODULES: SYSTEM

9/75   4A                    52.0
       4B                    53.0
       SYSTEM                                                               720   395

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   9/75      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE     9/75      COMMENTS:
                        SCRUBBER MODULES WERE RETURNED TO SERVICE ON SEPT. 21 AFTER REPLACEMENT OF
                        THE ORIGINAL I.D. FAN ON MODULE 4B SIDE.
           AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   9/75      EQUIPMENT: SCRUBBER
           END DATE     9/75      COMMENTS:
                        THE MARBLE BED WAS REMOVED FROM MODULE A AND REPLACED WITH A STAINLESS
                        STEEL PERFORATED BED. THE MARBLES WERE REMOVED BECAUSE OF CONTINUING
                        OPERATIONAL DIFFICULTIES. NEW DESIGN RESULTED IN INCREASED AVAILABILITY
                        AND CONTINUED HIGH PARTICULATE EFFICIENCY (97 PERCENT).
           AFFECTED MODULES: 4A

10/75  4A                    60.0
       4B                    91.0
       SYSTEM                                                               744   721

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE  10/75      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE    10/75      COMMENTS:
                        THE EXPERIMENT WITH A PROCESS CHEMISTRY OF 100% BLOWDOWN AND ZERO PERCENT
                        SOLIDS IS STILL IN PROGRESS. SO2 REMOVAL EFFICIENCY IS IN THE 50 TO 60
                        PERCENT RANGE. KCP&L IS CONCENTRATING ON PARTICULATE CONTROL.
           AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE  10/75      EQUIPMENT:
           END DATE    10/75      PROBLEM: NOT DEFINED/SPECIFIED
                        THERE WAS A MINOR BOILER RESTRICTION ON THE A-SIDE BETWEEN THE ECONOMIZER
                        AND THE INLET DRAFT DUCT.
           AFFECTED MODULES: 4A

11/75  4A
       4B                    99.0
       SYSTEM                                                               720   720

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE  11/75      EQUIPMENT: RECYCLE TANK
           END DATE    11/75      PROBLEM: CHEMICAL-RELATED PLUGGING
                        MODULE 4A WAS SHUT DOWN DURING THE REPORT PERIOD DUE TO LOSS OF DRAFT
                        THROUGH THE DUCTWORK FROM THE ECONOMIZER TO THE AIR PREHEATER, RESULTING
                        IN FREQUENT PLUGGING OF THE REHEATER UNTIL THE SYSTEM WAS SHUT DOWN.
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-------------------------------------PERFORMANCE DATA----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                               SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
             AFFECTED MODULES: 4A

12/75  4A
       4B                      16.0
       SYSTEM                                                                   744   640

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  12/75     EQUIPMENT: BOILER-RELATED
             END DATE    12/75     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                          THE BOILER OUTAGE OF 5 DAYS WAS DUE TO A SCHEDULED OVERHAUL.
             AFFECTED MODULES: SYSTEM

 1/76  4A
       4B
       SYSTEM                                                                   744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   1/76     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     1/76     PROBLEM: NOT DEFINED/SPECIFIED
                          THE SYSTEM WAS DOWN ALL MONTH DUE TO FROZEN EQUIPMENT AND LINES  MANPOWER
                          WAS ASSIGNED TO A BOILER AND TURBINE OVERHAUL ON ANOTHER UNIT.
             AFFECTED MODULES: SYSTEM

 2/76  4A
       4B                      78.0
       SYSTEM                                                                   696   579

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   2/76     EQUIPMENT: DUCTWORK
             END DATE     2/76     PROBLEM: NOT DEFINED/SPECIFIED
                         MODULE 4A WAS SHUT DOWN THE ENTIRE MONTH BECAUSE OF CONTINUING LOSS OF
                          DRAFT THROUGH THE DUCTWORK FROM THE ECONOMISER TO THE AIR PREHEATER.
             AFFECTED MODULES: 4A

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   2/76     EQUIPMENT: SCRUBBER
             END DATE     2/76     PROBLEM: CHEMICAL-RELATED PLUGGING
                          MODULE B EXPERIENCED PLUGGING IN THE MARBLE BED.
             AFFECTED MODULES: 4B

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   2/76     EQUIPMENT: RECYCLE PUMP
             END DATE     2/76     PROBLEM: NOT DEFINED/SPECIFIED
                          A RECYCLE PUMP BROKE DOWN ON THE B-SIDE.
             AFFECTED MODULES: 4B

 3/76  4A
       4B                       3.0
       SYSTEM                                                                   744   706

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   3/76     EQUIPMENT: GAS DAMPER
             END DATE     4/76     COMMENTS:
                          THE UNIT'S BYPASS SEALS WERE REPLACED WITH SLIDE-GATE DAMPERS.
             AFFECTED MODULES: SYSTEM

 4/76  4A                      42.0
       4B                      40.0
       SYSTEM                                                                   720   550

 5/76  4A                      27.0
       4B                      27.0
       SYSTEM                                                                   744   365

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   5/76     EQUIPMENT: RECYCLE TANK
             END DATE     6/76     PROBLEM: CHEMICAL-RELATED PLUGGING
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-----------------------------------------PERFORMANCE DATA-------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER   FGD   CAP.
                                                                 SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------
                           ONE OF THE REHEAT TUBE BUNDLES WAS REMOVED TO FACILITATE CLEANING AND
                           MAINTENANCE DUE TO PLUGGING PROBLEMS.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   5/76     EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     6/76     COMMENTS:
                           CURRENTLY, THE UTILITY IS IN THE PROCESS OF MODIFYING THE SCRUBBING SYSTEM
                           FROM A LIMESTONE INJECTION AND TAIL-END SCRUBBING BASED SYSTEM TO A LIME
                           SLURRY BASED SYSTEM.
              AFFECTED MODULES: SYSTEM

 6/76  4A                      65.0
       4B                        5.0
       SYSTEM                                                                  720   460

 7/76  SYSTEM                                                                  744

 8/76  SYSTEM                                                                  744

 9/76  SYSTEM                                                                  720

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   9/76     EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE    10/76     COMMENTS:
                           THE SYSTEM WAS OUT OF SERVICE VIRTUALLY THE ENTIRE REPORT PERIOD DUE TO A
                           MAJOR EXPLOSION WHICH OCCURRED IN THE COAL MILL PULVERIZING AREA OF UNIT 5
                           WHICH SERIOUSLY HAMPERED OPERATIONS AND MANPOWER COMMITMENTS.
              AFFECTED MODULES: SYSTEM

10/76  SYSTEM                                                                  744

11/76  4A                       91.0
       4B
       SYSTEM                                                                  720   786

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  11/76     EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE    12/76     COMMENTS:
                           THE UTILITY IS IN THE PROCESS OF CONVERTING THE SYSTEM TO A WET LIME
                           SCRUBBING SYSTEM, WHICH WILL COMMENCE OPERATIONS IN THE FIRST PART OF
                           JANUARY.
              AFFECTED MODULES: SYSTEM

12/76  4A
       4B
       SYSTEM                                                                  744

 1/77  4A                      85.0
       4B                      74.0
       SYSTEM                                                                  744   572

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   1/77     EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     3/77     COMMENTS:
                           THE UNIT BECAME AVAILABLE FOR SERVICE IN THE LIME SCRUBBING MODE ON JAN. 1
                           1977. TESTING FOR COMPLIANCE WITH PARTICULATE CODES OCCURRED DURING THE
                           MONTH. THE UNIT WAS FOUND TO MEET THE EMISSION REGULATION OF 0.17 LB/MM BT
                           BURNING 2.0% SULFUR COAL. SYSTEM OPERATIONS ARE STILL CONTINUING AT 0%
                           SOLIDS AND 100% BLOWDOWN. THE FRESH WATER MAKE-UP REQUIREMENT IS 7/0 GPMVM
              AFFECTED MODULES: SYSTEM

 2/77  4A                      80.0
       4B                      50.0
       SYSTEM                                                                  672   591

 3/77  4A                      82.0
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-----------------------------------------PERFORMANCE DATA-------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                               SO2  PART.  HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
       4B                     97.0
       SYSTEM                                                                744   539

4/77   4A                     43.0
       4B                     43.0
       SYSTEM                                                                720   720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   4/77     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     5/77     COMMENTS:
                         THE SYSTEM IS NOW OPERATING WELL AT ABOUT 15-25% BLOWDOWN. THE PH CONTROL
                         SYSTEM OPERATIONS HAVE BEEN EXCELLENT. DURING MAY THE BOILER BURNED GAS FO
                         40 HOURS (NOT INCLUDED IN THE OPERABILITY VALUES). SO2 REMOVAL EFFICIENCY
                         IS ESTIMATED AT 50-60% FOR BOTH MODULES. ALTHOUGH ACTUAL TESTS HAVE NOT
                         BEEN RUN FOR ONE-AND-A-HALF YEARS. CURRENTLY BOTH MODULES ARE BEING OPERA-
                         TED SIMULTANEOUSLY.
            AFFECTED MODULES: SYSTEM

5/77   4A                     54.0
       4B                     54.0
       SYSTEM                                                                744   740

6/77   SYSTEM                                                                720   720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   6/77     EQUIPMENT: BOILER-RELATED
            END DATE     6/77     COMMENTS:
                         UNIT NO. 4 FIRED GAS THROUGHOUT THE MONTH, ALLOWING THE SCRUBBER PLANT TO
                         BE SHUT DOWN FOR MODIFICATIONS DURING THE PERIOD.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   6/77     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     6/77     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                         MODIFICATIONS TO THE SCRUBBER MODULES INCLUDED: REPLACEMENT OF THE UNDER-
                         BED SPRAY HEADERS WITH 316L STAINLESS STEEL, INSTALLATION OF A NEW REACTIO
                         TANK LINER, AND REPLACEMENT OF THE ORIGINAL CARBON STEEL PIPING WITH
                         RUBBER-LINED PIPING (FROM THE RECYCLE PUMPS TO THE SPRAY MANIFOLD).
            AFFECTED MODULES: SYSTEM

7/77   4A
       4B
       SYSTEM                                                                744   696

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   7/77     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     7/77     COMMENTS:
                         THE STAINLESS STEEL MODIFICATIONS WERE COMPLETED BY JULY 25 AND THE UNIT
                         RESUMED COAL FIRING. THE SCRUBBER MODULES WERE IN SERVICE APPROXIMATELY
                         120 HOURS FOR THE REMAINDER OF THE MONTH. THE SYSTEM SUCCESSFULLY COMPLETE
                         FEDERAL PARTICULATE REMOVAL TESTS (0.15 LB/MM BTU MEASURED) DURING THIS
                         TIME, WHILE BURNING HIGH SULFUR, HIGH ASH (PEABODY-OKLAHOMA) COAL. OPACITY
                         TESTS FOR BOTH UNITS 3 AND 4 WILL BE CONDUCTED IN SEPTEMBER.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/77     EQUIPMENT: THICKENER
            END DATE     9/77     PROBLEM: CHEMICAL-RELATED PLUGGING
                         DURING THE LATTER PART OF SEPTEMBER THE CALRIFIER BECAME PLUGGED. THE UNIT
                         FIRED NATURAL GAS UNTIL THE CLARIFIER WAS CLEANED.
            AFFECTED MODULES: SYSTEM

8/77   4A                     74.0
       4B                     74.0
       SYSTEM                                                                744   550

9/77   4A                     73.0
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

		PERFORMANCE DATA									
PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
	4P		73.0								
	SYSTEM							720	589		
10/77	SYSTEM	74.0						744	550	550	
11/77	SYSTEM	69.0						720	496	496	
12/77	SYSTEM	70.0						744	520	520	
1/78	SYSTEM	68.0						744	508	508	
2/78	SYSTEM				25.0			672	672	167	

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 2/78 EQUIPMENT: BOILER-RELATED
END DATE 3/78 PROBLEM: NOT DEFINED/SPECIFIED
THE UNIT WAS DOWN THREE TIMES DURING FEBRUARY FOR NON-SCRUBBER RELATED PROBLEMS AND ONCE FOR A FUEL SAFETY TRIP. IN MARCH THERE WERE THREE ECONOMIZER LEAK OUTAGES (APPROX. 231 HOURS).
AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 2/78 EQUIPMENT: SCRUBBER
END DATE 3/78 PROBLEM: NOT DEFINED/SPECIFIED
THE UNIT WAS DOWN ONCE IN FEBRUARY AND AGAIN FOR 32 HOURS IN MARCH FOR GENERAL MAINTENANCE.
AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
3/78	SYSTEM				56.0			744	744	406	
4/78	SYSTEM				76.0			720	720	220	

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 4/78 EQUIPMENT: THICKENER
END DATE 5/78 PROBLEM: CHEMICAL-RELATED PLUGGING
FGD OUTAGE IN MAY WAS DUE TO CLARIFIER PLUGGING.
AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 4/78 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 5/78 COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
APRIL OUTAGE TIME WAS FOR SCHEDULED GENERAL MAINTENANCE AND CLEANING.
AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
5/78	SYSTEM				42.0			744	744	403	
6/78	SYSTEM							720			

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 6/78 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 7/78 COMMENTS:
NO INFORMATION WAS AVAILABLE FOR THE JUNE-JULY PERIOD BECAUSE OF A PLANT STRIKE.
AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
7/78	SYSTEM							744			
8/78	SYSTEM							744			

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 8/78 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 9/78 COMMENTS:
THE SCRUBBING SYSTEM IS OPERATING ALTHOUGH THE UTILITY IS STILL IN THE MIDST OF A STRIKE. FGD PERFORMANCE FIGURES ARE NOT AVAILABLE BECAUSE THE UTILITY IS NOT RECORDING FGD OPERATION HOURS DURING THE STRIKE.
AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
9/78	SYSTEM							720			

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------------------------------------PERFORMANCE DATA-------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

10/78  SYSTEM                                                                 744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/78     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    11/78     COMMENTS:
                                  ALTHOUGH THE STRIKE IS OVER NO OPERATIONAL DATA IS AVAILABLE.  THE FGD
                                  SYSTEM IS IN OPERATION.
            AFFECTED MODULES: SYS*

11/78  SYSTEM                                                                 720

12/78  SYSTEM                                                                 744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/78     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     1/79     COMMENTS:
                                  HOURS OF OPERATION ARE STILL NOT AVAILABLE.  THE FGD SYSTEM IS IN OPERATIO
                                  BUT AT PRESENT PERSONEL ARE BEING REASSIGNED PREVENTING ACCURATE DATA
                                  RECORDING.
            AFFECTED MODULES: SYSTEM

 1/79  SYSTEM                                                                 744
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

COMPANY NAME	KANSAS CITY POWER & LIGHT	
PLANT NAME	LA CYGNE	
UNIT NUMBER	1	
CITY	LA CYGNE	
STATE	KANSAS	
REGULATORY CLASSIFICATION	C	
PARTICULATE EMISSION LIMITATION - NG/J	55.	(.128 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J	645.	(1.500 LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW	1450.0	
GROSS UNIT GENERATING CAPACITY - MW	874.0	
NET UNIT GENERATING CAPACITY W/FGD - MW	820.0	
NET UNIT GENERATING CAPACITY WO/FGD - MW	844.0	
EQUIVALENT SCRUBBED CAPACITY - MW	874.0	
** BOILER DATA		
SUPPLIER	BABCOCK AND WILCOX	
TYPE	PULV. COAL, SUPERCRITICAL, CYCLONE FIRED	
SERVICE LOAD	BASE	
COMMERCIAL SERVICE DATE	0/73	
MAXIMUM BOILER FLUE GAS FLOW - CU.M/S	1302.44	(2760000 ACFM)
FLUE GAS TEMPERATURE - C	140.6	(285 F)
STACK HEIGHT - M	213.	(700 FT)
STACK TOP DIAMETER - M	*******	(***** FT)
** FUEL DATA		
FUEL TYPE	COAL	
FUEL GRADE	SUBBITUMINOUS	
AVERAGE HEAT CONTENT - KJ/KG	21913.	(9421 BTU/LB)
RANGE HEAT CONTENT - BTU/LB		9000-9700
AVERAGE ASH CONTENT - %	24.36	
RANGE ASH CONTENT - %	24-25	
AVERAGE MOISTURE CONTENT - %	8.60	
RANGE MOISTURE CONTENT - %	9-10	
AVERAGE SULFUR CONTENT - %	5.39	
RANGE SULFUR CONTENT - %	5-6	
AVERAGE CHLORIDE CONTENT - %	.03	
RANGE CHLORIDE CONTENT - %	0.02-0.03	
FUEL FIRING RATE - M T/H	366.4	(404 TPH)
FUEL FIRING RATE - MW	820	
** PARTICULATE SCRUBBER		
NUMBER	8	
TYPE	VARIABLE THROAT VENTURI	
SUPPLIER	BABCOCK AND WILCOX	
NUMBER OF STAGES	1	
SHELL MATERIAL	316L SS	
LINING MATERIAL	KAOCRETE CERAMIC	
NUMBER OF NOZZLES	80	
TYPE OF NOZZLES	SPINNER VANE, COORS CERAMIC	
BOILER LOAD/SCRUBBER - %	12.5	
FLUE GAS CAPACITY - CU.M/S	162.8	(345000 ACFM)
FLUE GAS TEMPERATURE - C	57.2	(135 F)
LIQUID RECIRCULATION RATE - LITER/S	315.0	(5000 GPM)
L/G RATIO - LITER/CU.M	1.6	(12.0 GAL/1000ACF)
PRESSURE DROP - KPA	1.7	(7 IN-H2O)
SUPERFICIAL GAS VELOCITY - M/S	39.6	(130.0 FT/S)
PARTICULATE DESIGN REMOVAL EFFICIENCY - %	98.2	
SO2 INLET CONCENTRATION - PPM	4500.000	
** FGD SYSTEM		
SALEABLE PRODUCT/THROWAWAY PRODUCT	THROWAWAY PRODUCT	
GENERAL PROCESS TYPE	WET SCRUBBING	
PROCESS TYPE	LIMESTONE	
SYSTEM SUPPLIER	BABCOCK & WILCOX	
DEVELOPMENT LEVEL	FULL-SCALE	
NEW/RETROFIT	NEW	
PARTICULATE DESIGN REMOVAL EFFICIENCY - %	99.50	
SO2 DESIGN REMOVAL EFFICIENCY - %	80.00	
COMMERCIAL DATE	6/73	
INITIAL START-UP	2/73	
CONSTRUCTION INITIATION	4/69	
** ABSORBER		
NUMBER	8	
TYPE	SIEVE TRAY TOWER	
INITIAL START UP	2/73	

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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     SUPPLIER                                     BABCOCK & WILCOX
     NUMBER OF STAGES                                2
     DIMENSIONS                                   32 X 16 X 25
     SHELL MATERIAL                               316L SS
     SHELL LINER MATERIAL                         NONE
     INTERNAL MATERIAL                            316L SS SIEVE TRAY
     NUMBER OF NOZZLES                              16
     NOZZLE TYPE                                  SPINNER-VANE, CERAMIC
     BOILER LOAD/ABSORBER - %                       12.5
     GAS FLOW - CU.M/S                             112.55       ( 238500 ACFM)
     GAS TEMPERATURE - C                            50.0        (  122 F)
     LIQUID RECIRCULATION RATE - LITER/S           567.         ( 9000 GPM)
     L/G RATIO - L/CU.M                              3.5        ( 26.5 GAL/1000ACF)
     PRESSURE DROP - KPA                             1.5        ( 6.0 IN-H2O)
     SUPERFICAL GAS VELOCITY - M/SEC                 4.6        ( 15.0 FT/S)
     SO2 OUTLET CONTRATION - PPM                  1000

 ** FANS
     NUMBER                                        6
     TYPE                                         FGD I.D.
     CONSTRUCTION MATERIALS                       SS CLIP ON EACH BLADE

 ** FANS
     NUMBER                                        3
     TYPE                                         BOILER I.D.

 ** MIST ELIMINATOR
     NUMBER                                       8
     TYPE                                         SIEVE TRAY
     CONSTRUCTION MATERIAL                        SS

 ** MIST ELIMINATOR
     NUMBER                                        6
     TYPE                                         CHEVRON (2 CHEVRONS IN 3 MODULES)
     CONSTRUCTION MATERIAL                        FRP
     FREEBOARD DISTANCE - M                           3.66        (12.0 FT)
     DEPTH - M                                         .24        (  .8 FT)
     VANE SPACING - CM                                7.6         ( 3.00 IN)
     VANE ANGLES                                  45 DEG.
     WASH SYSTEM                                  CONT. 230 GPM OVERSPRAY
     SUPERFICIAL GAS VELOCITY - M/S                  2.6         (  8.4 FT/S)
     PRESSURE DROP - KPA                               .3         ( 1.4 IN-H2O)

 ** MIST ELIMINATOR
     NUMBER                                        5
     TYPE                                         CHEVRON
     CONSTRUCTION MATERIAL                        FRP
     FREEBOARD DISTANCE - M                           3.66        (12.0 FT)
     DEPTH - M                                         .24        (  .8 FT)
     VANE SPACING - CM                                7.6         ( 3.00 IN)
     VANE ANGLES                                  45 DEG.
     WASH SYSTEM                                  CONT. 230 GPM OVERSPRAY
     SUPERFICIAL GAS VELOCITY - M/S                  2.6         (  8.4 FT/S)
     PRESSURE DROP - KPA                               .3         ( 1.4 IN-H2O)

 ** PROCESS CONTROL CHEMISTRY
     CONTROL VARIABLES                            PH, SOLIDS %
     CONTROL RANGE                                PH(5.6-5.8)
     CONTROL MANNER                               AUTOMATIC
     SENSOR LOCATION                              PH AT VENTURI, SOLIDS AT VENTURI RECIRC. LINE

 ** PUMPS
     SERVICE                                      NUMBER
     -------                                      ------
     POND WATER RETURN                               2
     LIMESTONE SLURRY MAKEUP                         1
     TRAY TOWER ABSORBER                             8
     VENTURI                                         8

 ** TANKS
     SERVICE                                      NUMBER
     -------                                      ------
     LIMESTONE SLURRY MAKEUP                         2
     RECYCLE TANK                                    8
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** REHEATER
    NUMBER                                          1
    TYPE                                            IN-LINE
    HEATING MEDIUM                                  STEAM
    TEMPERATURE BOOST - C                             33.3         (   60 F)

** REHEATER
    NUMBER                                          1
    TYPE                                            INDIRECT HOT AIR
    TEMPERATURE BOOST - C                             33.3         (   60 F)

** WATER LOOP
    TYPE                                            OPEN
    FRESH MAKEUP WATER ADDITION - LITERS/S            72.3         ( 1148 GPM)

** REAGENT PREPARATION EQUIPMENT
    NUMBER OF BALL MILLS                               2
    REAGENT PRODUCT - % SLURRY SOLIDS                66.0

** DISPOSAL
    NATURE                                          FINAL
    TYPE                                            UNLINED POND
    LOCATION                                        ON-SITE
    TRANSPORTATION                                  RUBBER LINED PIPE
    AREA - ACRES                                      160.0
    CAPACITY - CU.M                                    2152480     (  1760.0 ACRE-FT)


---------------------------------------PERFORMANCE DATA-----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL    PER  BOILER  FGD   CAP.
                                                                SO2  PART.  HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- -----  ----- ------ ----- ------

12/72  SYSTEM                                                                 744

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/72      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    12/72      COMMENTS:
                        THE FIRST TRIAL OPERATION BEGAN ON DECEMBER 26, 1972 AND WAS PLAGUED WITH
                         NUMEROUS PROBLEMS.  SOME OF THESE PROBLEMS, SUCH AS VIBRATIONS OF THE
                         INDUCED-DRAFT FANS AND THEIR SENSITIVITY TO INBALANCE, OCCURRED EVEN BE-
                         FORE THE BOILER AS FIRED. AS THESE FABRICATION PROBLEMS WERE CORRECTED
                         AND THE FGD SYSTEM WENT INTO OPERATION TWO OTHER TYPES OF PROBLEMS AP-
                         PEARED THE FIRST TYPE ASSOCIATED WITH THE WET LIMESTONE PROCESS,INCLUDED
                         PLUGGING OF THE DEMISTER AND STRAINERS.  THE CORROSION ASSOCIATED WITH
                         CONDENSATION OF ACID VAPORS FROM THE GAS ONITHE REHEATER TUBE BUNDLES
                         WAS CONTROLLED BY INJECTION OF SLIP STREAMS OF HOT AIR FROM THE BOILER'S
                        COMBUSTION AIR HEATER INTO THE SCRUBBED FLUE GASES AT THE INLET TO THE
                        REHEATER UNITS.  THIS PRACTICE WHICH REDUCED THE MAXIMUM GENERATING
                        CAPACITY OF THE BOILER BY LIMITING THE AIR AVAILABLE FOR COAL COMBUSTION,
                        IS NO LONGER NECESSARY BECAUSE OF SYSTEM DESIGN MODIFICATIONS.
            AFFECTED MODULES: SYSTEM

 0/74  SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   0/74      EQUIPMENT:
            END DATE     0/ 0      COMMENTS:
                         THE 1974 FIGURES ARE BASED UPON ACTUAL SYSTEM OPERATION HOURS AS A
                         FUNCTION OF ACTUAL BOILER HOURS
            AFFECTED MODULES: SYSTEM

 1/74  A            49.0
       B            52.0
       C            44.0
       D            87.0
       E            23.0
       F            37.0
       G            81.0
       SYSTEM       50.0                                                      744

 2/74  A            66.0
```

PERFORMANCE DATA											
PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
	B	68.0									
	C	59.0									
	D	76.0									
	E	52.0									
	F	100.0									
	G	65.0									
	SYSTEM	69.0						672			
3/74	SYSTEM							744			
4/74	A	67.0									
	B	70.0									
	C	75.0									
	D	88.0									
	E	74.0									
	F	100.0									
	G		88.0								
	SYSTEM	80.0						720			
5/74	A	69.0									
	B	83.0									
	C	78.0									
	D	85.0									
	E	78.0									
	F	84.0									
	G	80.0									
	SYSTEM	80.0						744			
6/74	A	92.0									
	B	84.0									
	C	83.0									
	D	90.0									
	E	82.0									
	F	83.0									
	G	87.0									
	SYSTEM	86.0						720			
7/74	A	75.0									
	B	80.0									
	C	80.0									
	D	81.0									
	E	85.0									
	F	79.0									
	G	77.0									
	SYSTEM	80.0						744			
8/74	A	90.0									
	B	90.0									
	C	73.0									
	D	81.0									
	E	81.0									
	F	78.0									
	G	99.0									
	SYSTEM	85.0						744			
9/74	A	69.0									
	B	88.0									
	C	73.0									
	D	76.0									
	E	83.0									
	F	89.0									
	G	86.0									
	SYSTEM	81.0						720			
10/74	A	90.0									
	B	71.0									

PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
	C	60.0									
	D	61.0									
	E	84.0									
	F	85.0									
	G	84.0									
	SYSTEM	76.0						744			
11/74	A	90.0									
	B	71.0									
	C	60.0									
	D	61.0									
	E	84.0									
	F	85.0									
	G	84.0									
	SYSTEM	76.0						720			
12/74	SYSTEM							744			
0/75	SYSTEM										

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 0/75 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 0/75 COMMENTS:
THE 1975 FIGURES ARE BASED UPON SYSTEM AVAILABL HOURS AS A FUNCTION OF HOURS IN THE PERIOD.
AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
1/75	SYSTEM							744			
2/75	SYSTEM							672			
3/75	A	82.0									
	B	96.0									
	C	90.0									
	D	76.0									
	E	93.0									
	F	92.0									
	G	96.0									
	SYSTEM	90.0						744	694		

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 3/75 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 3/75 COMMENTS:
DURING REDUCED LOAD CONDITIONS SOME OF THE MODULES WERE NOT REQUIRED AND THEREFORE SHUT DOWN ALTHOUGH THEY WERE AVAILABLE. AVAILABILITY WAS THEREFOR HIGHER THAN SOME OF THE POSTED FIGURES INDICATE.
AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
4/75	SYSTEM							720			
5/75	A	95.0									
	B	85.0									
	C	94.0									
	D	90.0									
	E	90.0									
	F	89.0									
	G	83.0									
	SYSTEM	89.0						744	683		
6/75	A	88.0									
	B	85.0									
	C	84.0									
	D	85.0									
	E	84.0									
	F	86.0									
	G	89.0									
	SYSTEM	86.0						720	667		

```
------------------------------------------------PERFORMANCE DATA---------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------

 7/75  A           78.0
       B           90.0
       C           90.0
       D           84.0
       E           85.0
       F           87.0
       G           85.0
       SYSTEM                                                                 744   590

 8/75  A           75.0
       B           88.0
       C           87.0
       D           78.0
       E           92.0
       F           65.0
       G           83.0
       SYSTEM      84.0                                                       744   630

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/75     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     8/75     COMMENTS:
                        MODULES A AND D ARE USED FOR RESEARCH TESTS.  ONE MODULE IS SHUT DOWN EAC.
                        EVENING FOR CLEANING.
            AFFECTED MODULES: A      D

 9/75  A           78.0
       B           84.0
       C           84.0
       D           85.0
       E           79.0
       F           78.0
       G           74.0
       SYSTEM      80.0                                                       720   610

10/75  A           66.0
       B           77.0
       C           46.0
       D           74.0
       E           72.0
       F           73.0
       G           65.0
       SYSTEM      68.0                                                       744   231

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/75     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    11/75     PROBLEM: NOT DEFINED/SPECIFIED
                        THE SYSTEM WAS DOWN OCTOBER 16 TO NOVEMBER 13 OWING TO PROBLEMS WITH
                        THE GENERATOR AND I.D. AIR FAN.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/75     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    11/75     COMMENTS:
                        AVAILABILITY FIGURES FOR OCTOBER AND NOVEMBER DO NOT INCLUDE THE OUTAGE
                        TIME FROM OCTOBER 16 TO NOVEMBER 13.
            AFFECTED MODULES: SYSTEM

11/75  A           93.0
       B           90.0
       C           80.0
       D           93.0
       E           96.0
       F           89.0
       G           94.0
       SYSTEM      91.0                                                       720   346
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

		PERFORMANCE DATA									
PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
12/75	A	91.0									
	B	87.0									
	C	81.0									
	D	85.0									
	E	87.0									
	F	89.0									
	G	84.0									
	SYSTEM	86.0						744	597		

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 12/75 EQUIPMENT: BOILER-RELATED
END DATE 12/75 PROBLEM: NOT DEFINED/SPECIFIED
THREE BOILER OUTAGES OCCURRED DURING DECEMBER.
AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
1/76	A	86.0									
	B	85.0									
	C	91.0									
	D	72.0									
	E	84.0									
	F	52.0									
	G	84.0									
	SYSTEM	83.0						744	618		
2/76	A	94.0									
	B	90.0									
	C	86.0									
	D	91.0									
	E	92.0									
	F	93.0									
	G	95.0									
	SYSTEM	92.0						696	594		
3/76	A	92.0									
	B	90.0									
	C	88.0									
	D	93.0									
	E	94.0									
	F	91.0									
	G	91.0									
	SYSTEM	91.0						744	643		
4/76	SYSTEM							720			

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 4/76 EQUIPMENT: BOILER-RELATED
END DATE 5/76 COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
THE SYSTEM WAS SHUT DOWN ON APRIL 6 FOR A SCHEDULED BOILER, AIR PREHEATER, AND STACK BREECHING OVERHAUL. THE UNIT WAS RESTARTED ON MAY 10.
AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 4/76 EQUIPMENT: DUCTWORK
END DATE 5/76 PROBLEM: CHEMICAL-RELATED CORROSION
DURING THE OUTAGE SOME MAINTENANCE WAS PREFORMED ON THE SCRUBBER DUCTWORK, PRIMARILY BECAUSE OF CORROSION PROBLEMS.
AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
5/76	A	96.0									
	B	92.0									
	C	93.0									
	D	96.0									
	E	89.0									
	F	95.0									
	G	96.0									
	SYSTEM	94.0						744	436		

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------------------------------------------PERFORMANCE DATA------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                 SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  5/76      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    5/76      PROBLEM: NOT DEFINED/SPECIFIED
                          FROM MAY 10 TO THE END OF THE MONTH FOUR UNIT OUTAGES WERE ENCOUNTERED.
             AFFECTED MODULES: SYSTEM

 6/76  A            93.0
       B            94.0
       C            94.0
       D            95.0
       E            93.0
       F            93.0
       G            91.0
       SYSTEM       93.0                                                       720

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  6/76      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    6/76      PROBLEM: NOT DEFINED/SPECIFIED
                          FOUR FORCED MINOR SCRUBBER OUTAGES OCCURRED DURING JUNE.
             AFFECTED MODULES: SYSTEM

 7/76  A            96.0
       B            95.0
       C            92.0
       D            93.0
       E            93.0
       F            95.0
       G            94.0
       SYSTEM       94.0                                                       744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  7/76      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    7/76      PROBLEM: NOT DEFINED/SPECIFIED
                          TWO MINOR SCRUBBER OUTAGES OCCURRED DURING JULY.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  7/76      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    7/76      COMMENTS:
                          THE UNIT RECORDED ITS LARGEST MW-HOUR MONTH SINCE INITIATION OF COMMERCIAL
                          OPERATION
             AFFECTED MODULES: SYSTEM

 8/76  A            94.0
       B            93.0
       C            92.0
       D            94.0
       E            92.0
       F            90.0
       G            88.0
       SYSTEM       92.0                                                       744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  8/76      EQUIPMENT: BOILER-RELATED
             END DATE   10/76      PROBLEM: NOT DEFINED/SPECIFIED
                          THE UNIT WAS TAKEN OUT OF SERVICE AUGUST 24 FOR REPAIR OF A TURBINE BLADE.
                          THE UNIT WAS RETURNED TO SERVICE ON OCTOBER 20.  OPERATION WAS INTERMIT-
                          TENT PENDING TURBINE BLADE REBALANCING AND REESTABLISHMENT OF NORMAL
                          OPERATING CONDITIONS.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  8/76      EQUIPMENT: STACK
             END DATE   10/76      PROBLEM: NOT DEFINED/SPECIFIED
                          DURING THE TURBINE REPAIR PERIOD THE UTILITY COATED THE STACK INNER
                          STRUCTURE WITH PLASTITE 4005.
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---------------------------------------------PERFORMANCE DATA-----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   8/76     EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     8/76     COMMENTS:
                           THE AUGUST AVAILABILITY FIGURES DO NOT INCLUDE THE OUTAGE TIME.
              AFFECTED MODULES: SYSTEM

  9/76 SYSTEM                                                                  720

 10/76 SYSTEM                                                                  744

 11/76 A          95.0
       B          93.0
       C          94.0
       D          95.0
       E          94.0
       F          93.0
       G          94.0
       SYSTEM     94.0                                                         720   627

 12/76 A          87.0
       B          89.0
       C          81.0
       D          94.0
       E          94.0
       F          95.0
       G          91.0
       SYSTEM     90.0                                                         744   706

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   12/76     EQUIPMENT: RECYCLE PUMP
              END DATE     12/76     PROBLEM: NOT DEFINED/SPECIFIED
                           THE A-MODULE VENTURI RECYCLE PUMP EXPERIENCED SOME PROBLEMS AND WAS
                           REPAIRED.
              AFFECTED MODULES: A

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   12/76     EQUIPMENT: REAGENT HANDLING
              END DATE     12/76     PROBLEM: NOT DEFINED/SPECIFIED
                           THE C-MODULE'S REHEAT STEAM TUBE BUNDLES WERE INCREASED IN NUMBER FROM
                           FOUR TO EIGHT.
              AFFECTED MODULES: C

  1/77 A          94.0
       B          90.0
       C          95.0
       D          95.0
       E          95.0
       F          92.0
       G          90.0
       SYSTEM     93.0                                                         744   714

  2/77 A          93.0
       B          93.0
       C          93.0
       D          94.0
       E          93.0
       F          94.0
       G          88.0
       SYSTEM     93.0                                                         672   634

  3/77 A          94.0
       B          92.0
       C          86.0
       D          94.0
```

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------------------------------------------PERFORMANCE DATA-------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD    CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
       E            91.0
       F            94.0
       G            90.0
       SYSTEM       92.0
                                                                            744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    3/77      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE      3/77      COMMENTS:
                          THE EIGTH MODULE HAS BEEN INSTALLED.
            AFFECTED MODULES: H

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    3/77      EQUIPMENT: MIST ELIMINATOR
            END DATE      3/77      PROBLEM: NOT DEFINED/SPECIFIED
                          THE MIST ELIMINATORS IN TWO MODULES HAVE BEEN MODIFIED TO THE POINT WHERE
                          THEY HAVE BEEN OPERATING CONTINUOUSLY CLEAN.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    3/77      EQUIPMENT: REHEATER
            END DATE      3/77      PROBLEM: NOT DEFINED/SPECIFIED
                          ADDITIONAL BANKS OF STEAM TUBE BUNDLES HAVE BEEN INSTALLED IN SOME MODULES
                         50 F OF REHEAT HAS BEEN DETERMINED AS THE NECESSARY AMOUNT FOR THE
                          LA CYNGE NO. 1 UNIT.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    3/77      EQUIPMENT: PROCESS CONTROL
            END DATE      3/77      COMMENTS:
                          THE WATER LOOP IS NOW 95% CLOSED.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    3/77      EQUIPMENT: SLUDGE DISPOSAL
            END DATE      3/77      COMMENTS:
                          A NEW SETTLING POND IS BEING INSTALLED AT THE PLANT.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    3/77      EQUIPMENT: BOILER-RELATED
            END DATE      3/77      COMMENTS:
                          THE PLANT IS STILL GENERATING 700-720 MW DURING THE DAY AND 500-570 MW
                          AT NIGHT.
            AFFECTED MODULES: SYSTEM

4/77   A            96.0
       B            94.0
       C            97.0
       D            94.0
       E            95.0
       F            99.0
       G            95.0
       SYSTEM       95.0
                                                                            720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    4/77      EQUIPMENT: ABSORBER
            END DATE      4/77      COMMENTS:
                          THE EIGHT MODULE HAS BEEN RUN FOR TWO DAYS.
            AFFECTED MODULES: H

5/77   SYSTEM
                                                                            744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    5/77      EQUIPMENT: BOILER-RELATED
            END DATE      7/77      PROBLEM: NOT DEFINED/SPECIFIED
                          THE UNIT WAS SHUT DOWN IN MAY DUE TO TURBINE PROBLEMS.  THE UNIT RESTARTED
                          JULY 5, 1977.
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----------------------------------------------------------PERFORMANCE DATA----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   5/77      EQUIPMENT: MIST ELIMINATOR
              END DATE     5/77      PROBLEM: NOT DEFINED/SPECIFIED
                           THE MIST ELIMATOR WASHING CONFIGURATION IS BEING CHANGED TO WORK
                           COUNTERCURRENT TO THE GAS FLOW.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   5/77      EQUIPMENT: REHEATER
              END DATE     5/77      PROBLEM: NOT DEFINED/SPECIFIED
                           ADDITIONAL TUBE BUNDLES ARE BEING ADDED TO INCREASE THE REHEAT AREA.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   5/77      EQUIPMENT: SLUDGE DISPOSAL
              END DATE     5/77      COMMENTS:
                           THE NEW SETTLING POND IS STILL BEING DRAWN UP.  EXCAVATION HAS NOT BEGUN.
              AFFECTED MODULES: SYSTEM

6/77   SYSTEM                                                               720

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   6/77      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     6/77      COMMENTS:
                           MINOR CLEANOUT AND REPAIR WORK WAS DONE ON THE SCRUBBING SYSTEM DURING
                           THE TURBINE OUTAGE.
              AFFECTED MODULES: SYSTEM

7/77   A             95.0
       B             93.0
       C             94.0
       D             95.0
       E             95.0
       F             95.0
       G             95.0
       H             95.0
       SYSTEM        95.0                                                   744   528

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   7/77      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     7/77      COMMENTS:
                           RESUMPTION OF OPERATIONS WAS CONDUCTED WITH EIGHT SCRUBBER MODULES IN THE
                           FLUE GAS PATH, ENABLING THE UNIT TO OPERATE AT A MAXIMUM CONTINUOUS LOAD
                           CAPACITY OF 800-820 MW.
              AFFECTED MODULES: SYSTEM

8/77   A             89.0
       B             55.0
       C             93.0
       D             93.0
       E             90.0
       F             93.0
       G             93.0
       H             94.0
       SYSTEM        87.0                                                   744   507

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   8/77      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     8/77      COMMENTS:
                           PARTICULATE REMOVAL TESTS WERE CONDUCTED IN LATE AUGUST AND UNIT NO.1 HAS
                           PASSED THE COMPLIANCE REQUIREMENTS (0.13 LB/MM BTU).
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   8/77      EQUIPMENT: RECYCLE PUMP
              END DATE     8/77      PROBLEM: COMPONENT FAILURE, OTHER
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------------------------------------------PERFORMANCE DATA------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD    CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
                          MODULE B HAD LOW AVAILABILITY DUE TO THE BURNING OF THE RECIRCULATING
                          PUMP.  IT WAS REMOVED AND STARTED AGAIN AFTER 12 DAYS.
             AFFECTED MODULES: B

 9/77  A           93.0
       B           94.0
       C           89.0
       D           90.0
       E           93.0
       F           95.0
       G           92.0
       H           93.0
       SYSTEM      92.0                                                          720   524

10/77  A           91.0
       B           96.0
       C           89.0
       D           94.0
       E           93.0
       F           94.0
       G           89.0
       H           93.0
       SYSTEM      92.0                                                          744   456

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/77     EQUIPMENT: BOILER-RELATED
             END DATE    10/77     PROBLEM: NOT DEFINED/SPECIFIED
                          A 12 DAY OUTAGE IN OCTOBER WAS REQUIRED TO DESLAG THE BOILER.
             AFFECTED MODULES: SYSTEM

11/77  A           93.0
       B           96.0
       C           93.0
       D           94.0
       E           92.0
       F           93.0
       G           96.0
       H           95.0
       SYSTEM      94.0                                                          720   234

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  11/77     EQUIPMENT: BOILER-RELATED
             END DATE    12/77     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                          THE BOILER WAS SHUT DOWN NOVEMBER 15 BECAUSE OF A NECESSARY TURBINE
                          OVERHAUL.  THE BOILER WENT BACK ON LINE DECEMBER 25.
             AFFECTED MODULES: SYSTEM

12/77  A           98.0
       B           98.0
       C           96.0
       D           96.0
       E           96.0
       F           97.0
       G           98.0
       H           99.0
       SYSTEM      97.0                                                          744   300

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  12/77     EQUIPMENT: BOILER-RELATED
             END DATE    12/77     PROBLEM: NOT DEFINED/SPECIFIED
                          THERE WERE A FEW SMALL BOILER RELATED OUTAGES IN DECEMBER.
             AFFECTED MODULES: SYSTEM

 1/78  A           90.0
       B           95.0
       C           95.0
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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----------------------------------------------------------------------------------------------------------
------------------------------------------PERFORMANCE DATA------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                               SO2  PART.  HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
       D          95.0
       E          93.0
       F          94.0
       G          94.0
       H          94.0
       SYSTEM     94.0                                                      744   300

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    1/78     EQUIPMENT: BOILER-RELATED
            END DATE      1/78     PROBLEM: NOT DEFINED/SPECIFIED
                          THERE WERE SOME BOILER RELATED OUTAGES IN JANUARY, TOTALING ABOUT 50
                          HOURS.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    1/78     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE      1/78     COMMENTS:
                          THE FGD SYSTEM CONTINUED TO OPERATE WITHOUT ANY PROBLEMS.
            AFFECTED MODULES: SYSTEM

2/78   A          92.0
       B          93.0
       C          95.0
       D          94.0
       E          91.0
       F          97.0
       G          96.0
       H          93.0
       SYSTEM     94.0                                                      672   578

3/78   A          95.0
       B          95.0
       C          90.0
       D          95.0
       E          94.0
       F          95.0
       G          89.0
       H          93.0
       SYSTEM     93.0                                                      744   741

4/78   A          91.0
       B          92.0
       C          93.0
       D          91.0
       E          90.0
       F          92.0
       G          91.0
       H          91.0
       SYSTEM     91.0                                                      720   620

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    4/78     EQUIPMENT: BOILER-RELATED
            END DATE      4/78     PROBLEM: NOT DEFINED/SPECIFIED
                          THE BOILER WAS DOWN A TOTAL OF 100 HOURS IN APRIL.  THIS TIME INCLUDED
                          THREE OUTAGES DUE TO BOILER LEAKS AND LACK OF LOAD REQUIREMENT.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    4/78     EQUIPMENT: REHEATER
            END DATE      4/78     PROBLEM: NOT DEFINED/SPECIFIED
                          DURING THE BOILER OUTAGES MODIFICATIONS TO THE FGD SYSTEM INCLUDED
                          CHANGING THE REHEAT TUBE BUNDLES.
            AFFECTED MODULES: SYSTEM

5/78   A          89.0
       B          92.0
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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-----------------------------------------PERFORMANCE DATA--------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ----- ----- ------
       C          92.0
       D          93.0
       E          92.0
       F          91.0
       G          93.0
       H          86.0
       SYSTEM     91.0                                                        744   593

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    5/78      EQUIPMENT: BOILER-RELATED
              END DATE      5/78      PROBLEM: NOT DEFINED/SPECIFIED
                            IN MAY THE BOILER WAS DOWN TWICE FOR A TOTAL OF 15 HOURS.  OUTAGES WERE
                            AGAIN CAUSED BY BOILER LEAKS.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    5/78      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE      5/78      PROBLEM: NOT DEFINED/SPECIFIED
                            GENERAL MAINTENANCE AND REPAIRS ON THE FGD SYSTEM CONTINUED.
              AFFECTED MODULES: SYSTEM

 6/78  SYSTEM                                                                 720   150

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    6/78      EQUIPMENT: BOILER-RELATED
              END DATE      6/78      PROBLEM: NOT DEFINED/SPECIFIED
                            THE UNIT WAS UP FOR ONLY 15 HOURS IN JUNE.  IN THE FIRST PART OF JUNE
                            THERE WERE BOILER TUBE LEAKS.  FROM JUNE 8 TO JUNE 17 A BOILER OUTAGE WAS
                           NECESSARY FOR GENERATOR REPAIR.
              AFFECTED MODULES: SYSTEM

 7/78  A          88.0
       B          97.0
       C          92.0
       D          94.0
       E          88.0
       F          93.0
       G          93.0
       H          95.0
       SYSTEM     93.0                                                        744   341

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    7/78      EQUIPMENT: FAN
              END DATE      9/78      PROBLEM: NOT DEFINED/SPECIFIED
                            DURING THE JULY-SEPTEMBER PERIOD TWO I.D. FAN ROTERS WERE REPLACED.
              AFFECTED MODULES: SYSTEM

 8/78  A          92.0
       B          93.0
       C          95.0
       D          96.0
       E          93.0
       F          94.0
       G          95.0
       H          95.0
       SYSTEM     94.0                                                        744   577

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    8/78      EQUIPMENT: BOILER-RELATED
              END DATE      8/78      PROBLEM: NOT DEFINED/SPECIFIED
                            THERE WERE TWO BOILER OUTAGES IN AUGUST.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    8/78      EQUIPMENT: MIST ELIMINATOR
              END DATE      9/78      COMMENTS:
                            THE UTILITY IS EXPERIMENTING WITH A 3-STAGE MIST ELIMINATOR AND SOME
```

```
------------------------------------------------PERFORMANCE DATA-------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
                         DOUBLE STAGE MIST ELIMINATORS.  BETTER MIST ELIMINATION AT THE SCRUBBER
                         EXIT WOULD REDUCE THE FREQUENCY OF REHEATER CLEANING.
              AFFECTED MODULES: SYSTEM

 9/78   A          96.0
        B          96.0
        C          96.0
        D          96.0
        E          96.0
        F          96.0
        G          95.0
        H          97.0
        SYSTEM     96.0
                                                                             720   720
10/78   A          96.0
        B          96.0
        C          98.0
        D          97.0
        E          97.0
        F          98.0
        G          97.0
        H          96.0
        SYSTEM     97.0
                                                                             744   255
        ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   10/78      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE     11/78      COMMENTS:
                         THE UTILITY REPORTED THAT NO UNUSUAL OPERATING PROBLEMS WERE ENCOUNTERED.
              AFFECTED MODULES: SYSTEM

11/78   A          92.0
        B          95.0
        C          94.0
        D          93.0
        E          94.0
        F          93.0
        G          94.0
        H          96.0
        SYSTEM     94.0
                                                                             720   720
12/78   A          93.9
        B          92.9
        C          94.0
        D          95.0
        E          94.7
        F          90.5
        G          94.4
        H          94.7
        SYSTEM
                                                                             744   239
        ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   12/78      EQUIPMENT: BOILER-RELATED
           END DATE      1/79
                         DURING THIS PERIOD THE UNIT EXPERIENCED A MULTITUDE OF BOILER OUTAGES.
              AFFECTED MODULES: SYSTEM

 1/79   A          95.6
        B          96.5
        C          97.2
        D          96.3
        E          90.7
        F          97.2
        G          97.2
        H          95.4
        SYSTEM
                                                                             744   205
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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COMPANY NAME                                       KANSAS POWER & LIGHT
PLANT NAME                                         JEFFREY
UNIT NUMBER                                        1
CITY                                               WAMEGO
STATE                                              KANSAS
REGULATORY CLASSIFICATION                          B
PARTICULATE EMISSION LIMITATION - NG/J               43.         (  .100 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                      129.         (  .300 LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW                 2720.0
GROSS UNIT GENERATING CAPACITY - MW                 720.0
NET UNIT GENERATING CAPACITY W/FGD - MW             680.0
NET UNIT GENERATING CAPACITY WO/FGD - MW          *******
EQUIVALENT SCRUBBED CAPACITY - MW                   540.0

** BOILER DATA
   SUPPLIER                                        COMBUSTION ENGINEERING
   TYPE                                            TANGENTIALLY FIRED PULVERIZED COAL
   SERVICE LOAD                                    BASE
   COMMERCIAL SERVICE DATE                         **/**
   MAXIMUM BOILER FLUE GAS FLOW - CU.M/S           ********      (******* ACFM)
   FLUE GAS TEMPERATURE - C                          135.6       ( 276 F)
   STACK HEIGHT - M                                  183.        ( 600 FT)
   STACK TOP DIAMETER - M                          *******       (***** FT)

** FUEL DATA
   FUEL TYPE                                       COAL
   FUEL GRADE                                      ******
   AVERAGE HEAT CONTENT - KJ/KG                     18899.       (  8125 BTU/LB)
   RANGE HEAT CONTENT - BTU/LB                                    ******
   AVERAGE ASH CONTENT - %                             5.80
   RANGE ASH CONTENT - %                           ******
   AVERAGE MOISTURE CONTENT - %                       30.00
   RANGE MOISTURE CONTENT - %                      ******
   AVERAGE SULFUR CONTENT - %                           .32
   RANGE SULFUR CONTENT - %                        ******
   AVERAGE CHLORIDE CONTENT - %                         .01
   RANGE CHLORIDE CONTENT - %                      ******
   FUEL FIRING RATE - M T/H                          226.7       (250 TPH)
   FUEL FIRING RATE - MW                           *****

** ESP
   TYPE                                            COLD SIDE
   SUPPLIER                                        C-E WALTHER
   FLUE GAS TEMPERATURE - C                          135.6       (  276 F)
   PRESSURE DROP - KPA                                  .2       (    1 IN-H2O)

** FGD SYSTEM
   SALEABLE PRODUCT/THROWAWAY PRODUCT              THROWAWAY PRODUCT
   GENERAL PROCESS TYPE                            WET SCRUBBING
   PROCESS TYPE                                    LIMESTONE
   SYSTEM SUPPLIER                                 COMBUSTION ENGINEERING
   DEVELOPMENT LEVEL                               FULL-SCALE
   NEW/RETROFIT                                    NEW
   PARTICULATE DESIGN REMOVAL EFFICIENCY - %         99.00
   SO2 DESIGN REMOVAL EFFICIENCY - %                 60.00
   COMMERCIAL DATE                                  8/78
   INITIAL START-UP                                 8/78

** ABSORBER
   NUMBER                                           5
   TYPE                                            VERTICAL SPRAY TOWER (PRESSURIZED)
   INITIAL START UP                                 8/78
   INTERNAL MATERIAL                               316L SS
   PRESSURE DROP - KPA                                 1.0       ( 4.0 IN-H2O)

** ABSORBER
   NUMBER                                           1
   TYPE                                            VERTICAL SPRAY TOWER (PRESSURIZED) (SPARE)
   INITIAL START UP                                 8/78
   INTERNAL MATERIAL                               316L SS
   PRESSURE DROP - KPA                                 1.0       ( 4.0 IN-H2O)

** FANS
   NUMBER                                           4
   TYPE                                            BOILER I.D.
```

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                                   SECTION 3
                 DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
-------------------------------------------------------------------------------------

** MIST ELIMINATOR
     TYPE                                      CHEVRON
     CONSTRUCTION MATERIAL                     FIBERGLASS
     CONFIGURATION                             HORIZONTAL
     NUMBER OF PASSES                            2
     FREEBOARD DISTANCE - M                      1.22        ( 4.0 FT)
     VANE SPACING - CM                           5.1         ( 2.00 IN)
     VANE ANGLES                               45 DEG
     WASH SYSTEM                               POND WATER, 150 PSIG

** TANKS
     SERVICE                                   NUMBER
     -------                                   ------
     REACTION TANKS                              4

** REHEATER
     TYPE                                      BYPASS

** WATER LOOP
     TYPE                                      CLOSED
     FRESH MAKEUP WATER ADDITION - LITERS/S      35.1        (  557 GPM)

** REAGENT PREPARATION EQUIPMENT
     NUMBER OF BALL MILLS                        1
     BALL MILL CAPACITY- M T/H                   10.9        ( 12.0 TPH)

** TREATMENT
     TYPE                                      NON-PROPRIETARY
     PRODUCT CHARACTERISTICS                   MIXED WITH BOTTOM ASH

** DISPOSAL
     NATURE                                    FINAL
     TYPE                                      UNLINED POND
     LOCATION                                  ON SITE 1 MILE FROM PLANT
     TRANSPORTATION                            PUMPED


-----------------------------------------PERFORMANCE DATA--------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                 SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

 8/78  SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     9/78      COMMENTS:
                     THE SYSTEM IS IN THE SHAKEDOWN PHASE OF OPERATION.  EACH OF THE SIX
                     MODULES OPERATED DURING THIS PERIOD.  NO MAJOR PROBLEMS WERE REPORTED.
                     INTEGRATED OPERATION OF THE SYSTEM IS EXPECTED DURING THE FIRST HALF OF
                     OCTOBER.
            AFFECTED MODULES: SYSTEM

 9/78  SYSTEM                                                                720

10/78  SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   10/78     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     11/78     COMMENTS:
                     INTEGRATED OPERATION FOR THIS UNIT HAS NOT YET BEEN ACHIEVED.  A CERTIF-
                     ICATION TEST WHICH HAD BEEN SCHEDULED HAD TO BE CANCELLED DUE TO A BOILER
                     OUTAGE.  AT THIS TIME THE COLD WEATHER HAS FORCED POSTPONMENT OF THE TEST
                     INDEFINITELY.  MEANWHILE INTERMITTENT FGD OPERATIONS CONTINUE.
            AFFECTED MODULES: SYSTEM

11/78  SYSTEM                                                                720

12/78  SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   12/78     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     1/79      COMMENTS:
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
1/79	SYSTEM							744			

NO PROBLEMS HAVE BEEN REPORTED FOR THIS PERIOD.
AFFECTED MODULES: SYSTEM

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                                        SECTION 3
                      DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
---------------------------------------------------------------------------------------------------

COMPANY NAME
PLANT NAME                                     KANSAS POWER & LIGHT
UNIT NUMBER                                    LAWRENCE
CITY                                           4
STATE                                          LAWRENCE
REGULATORY CLASSIFICATION                      KANSAS
PARTICULATE EMISSION LIMITATION - NG/J         B
SO2 EMISSION LIMITATION - NG/J                   43.          (  .100 LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW              129.          (  .300 LB/MMBTU)
GROSS UNIT GENERATING CAPACITY - MW            *******
NET UNIT GENERATING CAPACITY W/FGD - MW          125.0
NET UNIT GENERATING CAPACITY WO/FGD - MW         115.0
EQUIVALENT SCRUBBED CAPACITY - MW              *******
                                                 125.0
** BOILER DATA
    SUPPLIER
    TYPE                                       COMBUSTION ENGINEERING
    SERVICE LOAD                               PULV. COAL, BALANCED DRAFT, TANGENTEALLY FIRED
    COMMERCIAL SERVICE DATE                    CYCLIC
    MAXIMUM BOILER FLUE GAS FLOW - CU.M/S       0/59
    FLUE GAS TEMPERATURE - C                     190.18       ( 403000 ACFM)
    STACK HEIGHT - M                             137.8        ( 280 F)
    STACK TOP DIAMETER - M                        37.         ( 120 FT)
                                                   2.4        (  8.0 FT)
** FUEL DATA
    FUEL TYPE
    FUEL GRADE                                 COAL
    AVERAGE HEAT CONTENT - KJ/KG               ******
    RANGE HEAT CONTENT - BTU/LB                 23260.        ( 10000 BTU/LB)
    AVERAGE ASH CONTENT - %                                    ******
    RANGE ASH CONTENT - %                            9.80
    AVERAGE MOISTURE CONTENT - %               ******
    RANGE MOISTURE CONTENT - %                 ********
    AVERAGE SULFUR CONTENT - %                 ******
    RANGE SULFUR CONTENT - %                          .55
    AVERAGE CHLORIDE CONTENT - %               ******
    RANGE CHLORIDE CONTENT - %                        .03
    FUEL FIRING RATE - M T/H                   ******
    FUEL FIRING RATE - MW                        45.3         ( 50 TPH)
                                                115
** PARTICULATE SCRUBBER
    NUMBER
    TYPE                                        2
    SUPPLIER                                   RECTANGULAR VARIABLE THROAT ROD DECK VENTURI
    NUMBER OF STAGES                           COMBUSTION ENGINEERING
    LINING MATERIAL                               1
    INTERNAL MATERIAL                          316L SS APPROACH AND THROAT
    TYPE OF NOZZLES                            RUBBER COATED FIBERGLASS (NOREL) RODS
    BOILER LOAD/SCRUBBER - %                   NON-ATOMIZING, FAN TYPE SPRAY
    FLUE GAS CAPACITY - CU.M/S                   50.0
    FLUE GAS TEMPERATURE - C                     95.1         ( 201500 ACFM)
    LIQUID RECIRCULATION RATE - LITER/S         137.8         (  280 F)
    L/G RATIO - LITER/CU.M                      226.8         ( 3600 GPM)
    PRESSURE DROP - KPA                            2.4        (18.0 GAL/1000ACF)
    PARTICULATE INLET LOAD - G/CU.M                2.2        (     9 IN-H2O)
    SO2 INLET CONCENTRATION - PPM                  6.9        (  3.03 GR/SCF)
                                                    .748
** FGD SYSTEM
    SALEABLE PRODUCT/THROWAWAY PRODUCT
    GENERAL PROCESS TYPE                       THROWAWAY PRODUCT
    PROCESS TYPE                               WET SCRUBBING
    SYSTEM SUPPLIER                            LIMESTONE
    DEVELOPMENT LEVEL                          COMBUSTION ENGINEERING
    NEW/RETROFIT                               FULL-SCALE
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %  RETROFIT
    SO2 DESIGN REMOVAL EFFICIENCY - %            98.90
    INITIAL START-UP                             73.00
                                                1/76
** ABSORBER
    NUMBER
    TYPE                                        2
    INITIAL START UP                           VERTICAL COUNTERCURRENT SPRAY TOWER
    SUPPLIER                                    1/76
    NUMBER OF STAGES                           COMBUSTION ENGINEERING
    SHELL MATERIAL                                7
    INTERNAL MATERIAL                          316L SS
                                               HEADERS OF FRP
```

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------------------------------------------------------------------------------------------------------------------------------

     NUMBER OF NOZZLES                          32
     BOILER LOAD/ABSORBER - %                   50.0
     GAS FLOW - CU.M/S                          82.35        ( 174500 ACFM)
     GAS TEMPERATURE - C                        51.1         (  124 F)
     LIQUID RECIRCULATION RATE - LITER/S       334.          ( 5300 GPM)
     L/G RATIO - L/CU.M                          4.0         ( 30.0 GAL/1000ACF)
     PRESSURE DROP - KPA                          .6         ( 2.5 IN-H2O)
     PARTICULATE OUTLET LOAD- G/CU.M              .1         (  .032 GR/SCF)
     PARTICULATE REMOVAL EFFICIENCY - %         98.9
     SO2 OUTLET CONTRATION - PPM               200
     SO2 DESIGN REMOVAL EFFICIENCY - %          73.0

 ** FANS
     NUMBER                                    2

 ** MIST ELIMINATOR
     NUMBER                                   8
     TYPE                                     CHEVRON
     CONSTRUCTION MATERIAL                    FRP
     CONFIGURATION                            HORIZONTAL
     WASH SYSTEM                              INTERMITTENT, HIGH PRESSURE WATER WASH DIRECTED

 ** MIST ELIMINATOR
     NUMBER                                   4
     TYPE                                     BULK ENTRAINMENT SEPARATOR
     CONSTRUCTION MATERIAL                    FRP
     WASH SYSTEM                              INTERMITTENT, HIGH PRESSURE WATER WASH DIRECTED

 ** PROCESS CONTROL CHEMISTRY
     CONTROL VARIABLES                        SO2, SLURRY FLOWS, PH, % SOLIDS, PRESSURE DROP
     CONTROL RANGE                            PH = 5.5-5.7
     CONTROL MANNER                           AUTOMATIC
     MODE                                     FEEDBACK
     SENSOR LOCATION                          PH PROBES IN REACTION TANKS

 ** PUMPS
     SERVICE                                  NUMBER
     -------                                  ------
     SLURRY FEED PUMPS (SCREW TYPE)             6
     MIST ELIMINATOR WASH PUMPS               ****
     MILL SLURRY PUMPS                          3
     CLASSIFICATION TANK TRANSFER PUMP          3
     RECYCLE SPRAY PUMPS                      ****

 ** TANKS
     SERVICE                                  NUMBER
     -------                                  ------
     TOWER RECIRCULATION TANK                   2
     VENTURI RECIRCULATION TANK                 2
     CLARIFICATION AND COLLECTION TANK          1
     DILUTION AND STORAGE TANK                  1
     REACTION TANK BLEED TANK                   1

 ** REHEATER
     TYPE                                     IN-LINE
     HEATING MEDIUM                           HOT WATER
     TEMPERATURE BOOST - C                      11.1        (   20 F)
     ENERGY REQUIRED                          1.25% OF BOILER OUTPUT

 ** THICKENER
     NUMBER                                    1

 ** WATER LOOP
     TYPE                                     CLOSED

 ** REAGENT PREPARATION EQUIPMENT
     NUMBER OF BALL MILLS                       1

 ** TREATMENT
     TYPE                                     NONPROPRIETARY; FORCED OXIDATION WITH AIR
     INLET- KG/S                               101.2        (13392 LB/MIN)
     INLET SOLIDS - %                           32.5
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** DISPOSAL
     NATURE                                        INTERIM
     TYPE                                          UNLINED POND
     LOCATION                                      ON-SITE
     AREA - ACRES                                     16.0

** DISPOSAL
     NATURE                                        FINAL
     TYPE                                          UNLINED POND
     LOCATION                                      ON-SITE
     TRANSPORTATION                                OVERFLOW FROM INTERIM SLUDGE POND
     AREA - ACRES                                     4.0

** DISPOSAL
     NATURE                                        FINAL
     TYPE                                          UNLINED POND
     LOCATION                                      ON-SITE
     TRANSPORTATION                                OVERFLOW FROM INTERIM SLUDGE POND
     AREA - ACRES                                     28.0

** DISPOSAL
     NATURE                                        FINAL
     TYPE                                          SLUDGE POND
     LOCATION                                      ON-SITE
     AREA - ACRES                                     28.0

** DISPOSAL
     NATURE                                        FINAL
     TYPE                                          SLUDGE POND
     LOCATION                                      ON-SITE
     AREA - ACRES                                     4.0


-------------------------------------------PERFORMANCE DATA-------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

 0/70  SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    0/70      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE      0/70      COMMENTS:
                         MAJOR MODIFICATIONS IN 1970 WERE SANDBLASTING AND COATING OF THE INTERIOR
                         OF THE SCRUBBERS, REPLACEMENT OF ALL INTERNAL STEEL PIPES WITH PLASTIC AND
                         FIBERGLASS, AND REPLACEMENT OF STAINLESS STEEL DEMISTERS WITH FIBERGLASS.
                         SINCE DEMISTER PLUGGING WAS NOT COMPLETELY ELIMINATED, THE UNIT WAS WASHED
                         MANUALLY EVERY NIGHT TO MAINTAIN THE REQUIRED OUTPUT.
           AFFECTED MODULES: SYSTEM

 0/72  SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    0/72      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE      0/72      COMMENTS:
                         THE MODIFICATIONS IN THE SUMMER OF 1972 ON THE TWO FGD MODULES INCLUDED
                         ENLARGEMENT OF THE CRYSTALLIZATION TANK, AND INSTALLATION OF NEW PLASTIC
                         SPRAY NOZZLES, NEW SLURRY PUMPS AND STRAINERS,AND NEW  MULTIPLE MIXERS
                         IN THE TANK.  PROBLEMS THAT REMAINED INCLUDED CORROSION, INEFFICIENT
                         DAMPERS, EXPANSION JOINT FAILURE, DEMISTER FOULING, RAPID EROSION OF THE
                         SLURRY PUMP, AND VALVE FAILURE.
           AFFECTED MODULES: SYSTEM

 0/73  SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    0/73      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE      0/73      COMMENTS:
                         OPERATION OF THE FGD SYSTEM SINCE THE FALL OF 1973 HAS BEEN THE MOST
                         SUCCESSFUL TO DATE.
           AFFECTED MODULES: SYSTEM

 0/74  SYSTEM
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----------------------------------------PERFORMANCE DATA------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD    CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

 6/75  SYSTEM                                                                720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   6/75     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     6/75     COMMENTS:
                        STATION LOAD IS REDUCED TO 50 PERCENT EVERYNIGHT.  THEREFOPE, ONE OF THE
                        MODULES CAN BE TAKEN OFF-LINE NIGHTLY OFR CLEANING OR REPAIR.  WYOMING COA
                        (0.5 PERCENT SULFUR) IS BEING BURNED  IN THE BOILER.  SOME NATURAL GAS HAS
                        BEEN BURNED SINCE JUNE 20.
            AFFECTED MODULES: SYSTEM

 7/75  SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   7/75     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     8/75     COMMENTS:
                        EACH MODULE IS HUT DOWN ONCE PER WEEK FOR INSPECTION AND CLEAN-UP.
            AFFECTED MODULES: SYSTEM

 8/75  SYSTEM                                                                744

 9/75  SYSTEM                                                                720

10/75  SYSTEM                                                                744

11/75  SYSTEM                                                                720

12/75  SYSTEM                                                                744

 1/76  SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/76     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     2/76     COMMENTS:
                        THE UTILITY IS REPLACING THE SCRUBBING SYSTEM WITH A VENTURI-ROD FOLLOWED
                        BY A SPRAY TOWER.
            AFFECTED MODULES: SYSTEM

 2/76  SYSTEM                                                                696

 3/76  SYSTEM                                                                744

 4/76  SYSTEM                                                                720

 5/76  SYSTEM                                                                744

 6/76  SYSTEM                                                                720

 7/76  SYSTEM                                                                744

 8/76  SYSTEM                                                                744

 9/76  SYSTEM                                                                720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/76     EQUIPMENT: BOILER-RELATED
            END DATE    12/76     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                        A SCHEDULED UNIT OURAGE COMMENCED IN MID-SEPTEMBER FOR A TURBINE OVERHAUL
                        AND RESTARTED IN EARLY JANUARY.
            AFFECTED MODULES: SYSTEM

10/76  SYSTEM                                                                744

11/76  SYSTEM                                                                720

12/76  SYSTEM                                                                744
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-------------------------------------------PERFORMANCE DATA------------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL    PER  BOILER  FGD   CAP.
                                                                SO2  PART.  HOURS  HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- -----  ----- ------ ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/76      EQUIPMENT: BOILER-RELATED
            END DATE    12/76      COMMENTS:
                                   THE UNIT CONTINUES TO FIRE LOW SULFUR WYOMING COAL.
            AFFECTED MODULES: SYSTEM

 1/77  SYSTEM                                                                  744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/77      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     1/77      COMMENTS:
                                   THE NEW LIMESTONE FGD SYSTEM BECAME COMMERCIALLY OPERABLE IN EARLY
                                   JANUARY 1977.  THE UTILITY REPORTS THAT BOTH PARTICULATE AND SO2 REMOVALS
                                   ARE QUITE SATISFACTORY.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/77      EQUIPMENT: TANK, OTHER
            END DATE     3/77      PROBLEM: NOT DEFINED/SPECIFIED
                                   MINOR PROBLEMS HAVE BEEN RELATED TO MAINTAINING DESIRED SOLIDS LEVEL IN TH
                                   MAKE-UP TANK.  MODIFICATIOON PLANS INCLUDE CESSATION OF SLURRY DILUTION,
                                   WHICH CURRENTLY PRECEDES THE INTRODUCTION OF THE FRESH LIMESTONE SLURRY
                                   INTO THE RECIRCULATION LOOP.  THE UTILITY PLANS TO PUMP THE 35 PERCENT
                                   SOLIDS SLURRY DIRECTLY FROM THE SLURRY TANK INTO THE RECIRCULATION LOOP.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/77      EQUIPMENT: PUMP, OTHER
            END DATE     3/77      COMMENTS:
                                   CURRENTLY SEVERAL DIFFERENT MAKES OF SLURRY PUMPS ARE BEING USED.  ALL ARE
                                   FUNCTIONING WELL SO FAR.  THE PUMPS HAVE NOT BEEN IN SERVICE LONG ENOUGH
                                   FOR COMPARISONS TO BE DRAWN.
            AFFECTED MODULES: SYSTEM

 2/77  SYSTEM                                                                  672

 3/77  SYSTEM                                                                  744

 4/77  SYSTEM                                                                  720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   4/77      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     5/77      COMMENTS:
                                   THE SCRUBBER WAS NOT REQUIRED FOR SERVICE DURING THE REPORT PERIOD BECAUSE
                                   NATURAL GAS WAS FIRED IN THE BOILER.
            AFFECTED MODULES: SYSTEM

 5/77  SYSTEM                                                                  744

 6/77  SYSTEM                                                                  720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   6/77      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     7/77      COMMENTS:
                                   THE NO. 3 BOILER HAS BEEN FIRING 100% NATURAL GAS FOR ALL BUT 8-10 DAYS
                                   SINCE THE BEGINNING OF APRIL 1977.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   6/77      EQUIPMENT: MIST ELIMINATOR
            END DATE     7/77      PROBLEM: NOT DEFINED/SPECIFIED
                                   MIST ELIMINATOR CRACKS HAVE BEEN A PROBLEM.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   6/77      EQUIPMENT: RECYCLE TANK
            END DATE     7/77      PROBLEM: NOT DEFINED/SPECIFIED
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SECTION 3

DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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------------------------------------------PERFORMANCE DATA--------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                               SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                          A COMPRESSOR BREAKDOWN IN THE RECYCLE TANK AIR AGITATION SYSTEM AND THE
                          RECYCLE TANK STRAINER SCREEN WASH HAVE BEEN PROBLEM AREAS.
              AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    6/77      EQUIPMENT: AUXILIARY EQUIPMENT
              END DATE      7/77
                          SCOT BLOWER PROBLEMS WERE ENCOUNTERED.
              AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    6/77      EQUIPMENT: PUMP, OTHER
              END DATE      6/77      PROBLEM: NOT DEFINED/SPECIFIED
                          THE DENVER SLURRY PUMPS ARE EXPERIENCING SOME ON-GOING PROBLEMS, WHILE
                          THE ALLEN-SHERMAN-HOFF PUMPS ARE OPERATING SATISFACTORILY.
              AFFECTED MODULES: SYSTEM

  7/77  SYSTEM                                                                 744

  8/77  SYSTEM                                                                 744

          ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    8/77      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE      8/77      COMMENTS:
                          THE BOILER BURNED NATURAL GAS THROUGHOUT AUGUST.
              AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    8/77      EQUIPMENT: MIST ELIMINATOR
              END DATE      8/77      COMMENTS:
                          THE MIST ELIMINATOR CRACKS HAVE BEEN REPAIRED.
              AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    8/77      EQUIPMENT: RECYCLE TANK
              END DATE      9/77      PROBLEM: NOT DEFINED/SPECIFIED
                          THE RECYCLE TANK STRAINER PROBLEMS PERSISTED AND THE AIR AGITATION SYSTEM
                          COMPRESSOR WAS MALFUNCTIONING.
              AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    8/77      EQUIPMENT: PUMP, OTHER
              END DATE      9/77      COMMENTS:
                          THE DENVER SLURRY PUMPS ARE FUNCTIONING ADEQUATELY AT PRESENT.  THE PUMP
                          GLAND PACKING ARE BEING REDESIGNED.
              AFFECTED MODULES: SYSTEM

  9/77  SYSTEM                                                                 720

          ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    9/77      EQUIPMENT: BOILER-RELATED
              END DATE      9/77      COMMENTS:
                          AS OF SEPTEMBER 15 THE UNIT BURNED COAL.
              AFFECTED MODULES: SYSTEM

 10/77  SYSTEM                                                                 744

          ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   10/77      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     10/77      COMMENTS:
                          THE SYSTEM CAPACITY WAS CUT BACK TO 50 PERCENT IN OCTOBER BECAUSE A NEW
                          COOLING TOWER IS BEING CONSTRUCTED.
              AFFECTED MODULES: SYSTEM

 11/77  SYSTEM                                                                 720

          ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   11/77      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     11/77      PROBLEM: NOT DEFINED/SPECIFIED
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----------------------------------------PERFORMANCE DATA--------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
                          ON NOVEMBER 15 A MAJOR FGD SYSTEM OVERHAUL TOOK PLACE WHILE THE TURBINE
                          WAS DWON FOR INSPECTION AND THE NEW COOLING TOWER WAS BEING CONNECTED.
             AFFECTED MODULES: SYSTEM

12/77  SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  12/77     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    12/77     COMMENTS:
                          THE UNIT CAME BACK ON LINE DECEMBER 20 AT FULL CAPACITY.
             AFFECTED MODULES: SYSTEM

 1/78  SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   1/78     EQUIPMENT: PIPING
             END DATE     1/78     PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                          THE FGD SYSTEM OPERATED WITHOUT ANY PROBLEMS OTHER THAN SOME FREEZING OF
                          THE PIPELINES.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   1/78     EQUIPMENT: THICKENER
             END DATE     1/78     PROBLEM: PLUGGING, OTHER
                          DISCHARGE LINE FREEZING CAUSED CLARIFIER PLUGGING.
             AFFECTED MODULES: SYSTEM

 2/78  SYSTEM                                                                672

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   2/78     EQUIPMENT: PIPING
             END DATE     3/78
                          THE THICKENER UNDERFLOW LINE IS STILL FROZEN AND TWO 3 INCH DIAMETER FIRE
                          HOSES ARE BEING USED TO PUMP THE UNDERFLOW SOLIDS TO THE POND.
             AFFECTED MODULES: SYSTEM

 3/78  SYSTEM                                                                744

 4/78  SYSTEM                                                                720

 5/78  SYSTEM                                                                744

 6/78  SYSTEM                                                                720

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   6/78     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     7/78     COMMENTS:
                          THE BOILER AND FGD SYSTEM BOTH OPERATED THROUGHOUT THE PERIOD WITHOUT
                          ANY FORCED OUTAGES.
             AFFECTED MODULES: SYSTEM

 7/78  SYSTEM                                                                744

 8/78  SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   8/78     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     9/78     COMMENTS:
                          THE UTILITY REPORTED THAT THE SYSTEM RAN WITH NO FORCED OUTAGES DURING THE
                          PERIOD.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   8/78     EQUIPMENT: BOILER-RELATED
             END DATE     8/78     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                          THE SYSTEM RAN CONTINUOUSLY THROUGHOUT THE PERIOD WITH THE EXCEPTION OF A
                          ONE WEEK OUTAGE FOR A BOILER-TURBINE INSPECTION.
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----------------------------------------PERFORMANCE DATA--------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION % REMOVAL     PER BOILER  FGD    CAP.
                                                               SO2   PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
             AFFECTED MODULES: SYSTEM

  9/78 SYSTEM                                                                720

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  9/78      EQUIPMENT: BOILER-RELATED
             END DATE    9/78      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                          THE UNIT WAS DOWN THE LAST WEEK AND A HALF IN SEPTEMBER FOR A SCHEDULED
                          FALL TURBINE/BOILER OUTAGE.  ROUTINE MAINTENANCE INCLUDED BOILER AND
                          TURBINE CLEANING AND REPAIR.
             AFFECTED MODULES: SYSTEM

 10/78 SYSTEM                                                                744

 11/78 SYSTEM                                                                720

 12/78 SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  12/78     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    12/78     COMMENTS:
                         AN EPA SPONSORED CONTINUOUS MONITORING TEST BEGAN AT THIS UNIT AT THE
                         BEGINNING OF DECEMBER AND WILL CONTINUE THROUGH THE END OF JANUARY.  THE
                         TEST INVOLVES 24 HOUR MONITORING OF SO2,OPACITY AND NOX.
             AFFECTED MODULES: SYSTEM

  1/79 SYSTEM                                                                744

  2/79 SYSTEM                                                                672

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  2/79      EQUIPMENT: AGITATOR
             END DATE    2/79      PROBLEM: COMPONENT FAILURE, OTHER
                          ONE MODULE WAS FORCED OUT OF SERVICE FOR 2 DAYS WHEN ITS TANK AGITATOR
                          FAILED.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  2/79      EQUIPMENT: FAN
             END DATE    2/79      PROBLEM: NOT DEFINED/SPECIFIED
                          ONE MODULE WAS FORCED OUT OF SERVICE FOR AN 8 DAY PERIOD DUE TO A FAN
                          MOTOR MALFUNCTION.
             AFFECTED MODULES: SYSTEM
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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COMPANY NAME                                  KANSAS POWER & LIGHT
PLANT NAME                                    LAWRENCE
UNIT NUMBER                                   5
CITY                                          LAWRENCE
STATE                                         KANSAS
REGULATORY CLASSIFICATION                     B
PARTICULATE EMISSION LIMITATION - NG/J          43.         (  .100 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                 215.         (  .500 LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW            *******
GROSS UNIT GENERATING CAPACITY - MW             420.0
NET UNIT GENERATING CAPACITY W/FGD - MW         400.0
NET UNIT GENERATING CAPACITY WO/FGD - MW      *******
EQUIVALENT SCRUBBED CAPACITY - MW               420.0

** BOILER DATA
    SUPPLIER                                  COMBUSTION ENGINEERING
    TYPE                                      PULV. COAL, BALANCED DRAFT, TANGENTIAL FIRED
    SERVICE LOAD                              CYCLIC
    COMMERCIAL SERVICE DATE                    0/71
    MAXIMUM BOILER FLUE GAS FLOW - CU.M/S       599.78       (1271000 ACFM)
    FLUE GAS TEMPERATURE - C                    148.9        ( 300 F)
    STACK HEIGHT - M                            114.         ( 375 FT)
    STACK TOP DIAMETER - M                    *******        (***** FT)

** FUEL DATA
    FUEL TYPE                                 COAL
    FUEL GRADE                                ******
    AVERAGE HEAT CONTENT - KJ/KG               23260.        ( 10000 BTU/LB)
    RANGE HEAT CONTENT - BTU/LB                               ******
    AVERAGE ASH CONTENT - %                        9.80
    RANGE ASH CONTENT - %                     ******
    AVERAGE MOISTURE CONTENT - %              ********
    RANGE MOISTURE CONTENT - %                ******
    AVERAGE SULFUR CONTENT - %                      .55
    RANGE SULFUR CONTENT - %                  ******
    AVERAGE CHLORIDE CONTENT - %                    .03
    RANGE CHLORIDE CONTENT - %                ******
    FUEL FIRING RATE - M T/H                    136.0        (150 TPH)
    FUEL FIRING RATE - MW                       400

** PARTICULATE SCRUBBER
    NUMBER                                      2
    TYPE                                      RECTANGULAR VARIABLE THROAT
    SUPPLIER                                  COMBUSTION ENGINEERING
    NUMBER OF STAGES                              1
    LINING MATERIAL                           316L SS APPROACH AND THROAT
    INTERNAL MATERIAL                         316L SS RODS
    TYPE OF NOZZLES                           NON-ATOMIZING, FAN TYPE SPRAY
    BOILER LOAD/SCRUBBER - %                     50.0
    FLUE GAS CAPACITY - CU.M/S                  299.7        ( 635000 ACFM)
    FLUE GAS TEMPERATURE - C                    148.9        (  300 F)
    LIQUID RECIRCULATION RATE - LITER/S         655.2        (10400 GPM)
    L/G RATIO - LITER/CU.M                        2.1        (16.0 GAL/1000ACF)
    PRESSURE DROP - KPA                           2.2        (    9 IN-H2O)
    SO2 INLET CONCENTRATION - PPM                  .748

** FGD SYSTEM
    SALEABLE PRODUCT/THROWAWAY PRODUCT        THROWAWAY PRODUCT
    GENERAL PROCESS TYPE                      WET SCRUBBING
    PROCESS TYPE                              LIMESTONE
    SYSTEM SUPPLIER                           COMBUSTION ENGINEERING
    DEVELOPMENT LEVEL                         FULL-SCALE
    NEW/RETROFIT                              RETROFIT
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %    98.90
    SO2 DESIGN REMOVAL EFFICIENCY - %            52.00
    INITIAL START-UP                          11/71

** ABSORBER
    NUMBER                                      2
    TYPE                                      VERTICAL COUNTERCURRENT SPRAY TOWER
    INITIAL START UP                           4/78
    SUPPLIER                                  COMBUSTION ENGINEERING
    NUMBER OF STAGES                              1
    SHELL MATERIAL                            316L SS
    INTERNAL MATERIAL                         HEADERS FRP, NOZZLES CERAMIC
    NUMBER OF NOZZLES                            16
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     BOILER LOAD/ABSORBER - %                        50.0
     GAS FLOW - CU.M/S                              256.71          ( 544000 ACFM)
     GAS TEMPERATURE - C                             52.2           (  126 F)
     LIQUID RECIRCULATION RATE - LITER/S            655.            (10400 GPM)
     L/G RATIO _ L/CU.M                               2.5           ( 19.0 GAL/1000ACF)
     PRESSURE DROP - KPA                               .6           ( 2.5 IN-H2O)
     PARTICULATE REMOVAL EFFICIENCY - %              98.9
     SO2 OUTLET CONTRATION - PPM                    359
     SO2 DESIGN REMOVAL EFFICIENCY - %               52.0

 ** FANS
     NUMBER                                      2

 ** MIST ELIMINATOR
     NUMBER                                      4
     TYPE                                        CHEVRON
     CONSTRUCTION MATERIAL                       FRP
     CONFIGURATION                               HORIZONTAL
     WASH SYSTEM                                 INTERMITTENT, HIGH PRESSURE WATER WASH DIRECTED

 ** MIST ELIMINATOR
     NUMBER                                      2
     TYPE                                        BULK ENTRAINMENT SEPARATOR
     CONSTRUCTION MATERIAL                       FRP
     WASH SYSTEM                                 INTERMITTENT, HIGH PRESSURE WATER WASH DIRECTED

 ** PROCESS CONTROL CHEMISTRY
     CONTROL VARIABLES                           SO2, SLURRY FLOWS, PH, % SOLIDS, PRESSURE CHANGE
     CONTROL RANGE                               PH=5.5-5.7
     CONTROL MANNER                              AUTOMATIC
     MODE                                        FEEDBACK
     SENSOR LOCATION                             PH PROBES IN REACTION TANKS

 ** PUMPS
     SERVICE                                     NUMBER
     -------                                     ------
     REACTION-RECYCLE TANK BLEED                 ****
     RECYCLE                                     ****
     SLURRY FEED PUMPS (SCREW TYPE)                 2
     SLURRY FEED PUMPS (SCREW TYPE) (SPAR           2
     MIST ELIMINATOR WASH PUMPS                  ****
     MILL SLURRY PUMP                               1
     MILL SLURRY PUMP (SPARE)                       1
     CLASSIFICATION TANK TRANSFER PUMP              1
     CLASSIFICATION TANK TRANSFER PUMP (S           1

 ** TANKS
     SERVICE                                     NUMBER
     -------                                     ------
     CLARIFICATION AND COLLECTION TANK              1
     DILUTION AND STORAGE TANK                      1
     RECIRCULATION AND REACTION                     1

 ** REHEATER
     TYPE                                        IN-LINE
     HEATING MEDIUM                              HOT WATER
     TEMPERATURE BOOST - C                          11.1         (   20 F)
     ENERGY REQUIRED                             1.25% OF BOILER OUTPUT

 ** WATER LOOP
     TYPE                                        CLOSED

 ** REAGENT PREPARATION EQUIPMENT
     NUMBER OF BALL MILLS                           1

 ** TREATMENT
     TYPE                                        NONPROPRIETARY; FORCED OXIDATION WITH AIR
     INLET SOLIDS - %                               10.0

 ** DISPOSAL
     NATURE                                      INTERIM
     TYPE                                        UNLINED POND
     LOCATION                                    ON-SITE
     AREA - ACRES                                   16.0
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 ** DISPOSAL
     NATURE                                        FINAL
     TYPE                                          UNLINED POND
     LOCATION                                      ON-SITE
     TRANSPORTATION                                OVERFLOW FROM INTERIM SLUDGE POND
     AREA - ACRES                                      4.0

 ** DISPOSAL
     NATURE                                        FINAL
     TYPE                                          UNLINED POND
     LOCATION                                      ON-SITE
     TRANSPORTATION                                OVERFLOW FROM INTERIM SLUDGE POND
     AREA - ACRES                                     28.0


------------------------------------------PERFORMANCE DATA------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION % REMOVAL    PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

 7/75  SYSTEM                                                               744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   7/75      EQUIPMENT: BOILER-RELATED
             END DATE     8/75      COMMENTS:
                          OIL AND GAS WERE IN JULY AND AUGUST, RESULTING IN NO FGD OPERATION.
             AFFECTED MODULES: SYSTEM

 8/75  SYSTEM                                                               744

 9/75  SYSTEM                                                               720

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   9/75      EQUIPMENT: BOILER-RELATED
             END DATE    10/75      COMMENTS:
                          GAS AND OIL WERE BURNED ON A PART TIME BASIS DURING SEPTEMBER AND OCTOBER.
                          BOILER OUTAGE WAS DUE TO INSPECTION AND TURBINE REPAIR.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   9/75      EQUIPMENT: RECYCLE TANK
             END DATE    10/75      PROBLEM: CHEMICAL-RELATED PLUGGING
                          ADDITIONAL BOILER OUTAGE WAS DUE TO REPLACEMENT OF THE SLURRY TANK SCREEN.
             AFFECTED MODULES: SYSTEM

10/75  SYSTEM                                                               744

11/75  SYSTEM                                                               720

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  11/75      EQUIPMENT:
             END DATE     1/76      COMMENTS:
                          PROJECTIONS BY UTILITY FOR THIS UNIT CALL FOR DAYS OF OPERATION IN
                          1976 WITH FUEL CONSUMPTION BEING 60 PERCENT COAL, 25 PERCENT FUEL OIL, AND
                          15 PERCENT GAS.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  11/75      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     1/75      COMMENTS:
                          LIKE UNIT 4 THIS UNIT MAY BE CONVERTED TO A VENTRI-ROD AND SPRAY TOWER
                          SCRUBBING SYSTEM.
             AFFECTED MODULES: SYSTEM

12/75  SYSTEM                                                               744

 1/76  SYSTEM                                                               744

 2/76  SYSTEM                                                               696

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   2/76      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     9/76      COMMENTS:
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				PERFORMANCE DATA							
PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR

NO INFORMATION HAS REPORTED BY THE UTILITY FOR THE PERIOD.
AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
3/76	SYSTEM							744			
4/76	SYSTEM							720			
5/76	SYSTEM							744			
6/76	SYSTEM							720			
7/76	SYSTEM							744			
8/76	SYSTEM							744			
9/76	SYSTEM							720			
10/76	SYSTEM							744			

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 10/76 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 12/76 COMMENTS:
THE BOILER FIRES NO. 2 FUEL OIL IN ADDITION TO LOW SULFUR WYOMING COAL WHILE THE NEW SCRUBBING FACILITIES ARE BEING INSTALLED. THE ORIGINAL INJECTION AND TAIL-END SCRUBBING SYSTEM IS STILL AVAILABLE FOR SERVICE AND OPERATED WHEN THE UNIT FIRES COAL. THE SYSTEM WILL TREAT FLUE GAS RESULTING FROM THE BURNING OF LOW SULFUR (0.5 PERCENT) WYOMING COAL.
AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 10/76 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 12/76 COMMENTS:
THE UTILITY REPORTS THAT THE INSTALLATION OF THE NEW ROD AND SPRAY TOWER SCRUBBING SYSTEM IS NOW IN PROGRESS. THE SYSTEM WILL CONSIST OF TWO SCRUBBING TRAINS EACH HANDLING 50 PERCENT OF THE FLUE GAS CAPACITY. FOUNDATION AND STRUCTURAL STEEL ERECTION HAS BEEN COMPLETED, AND SOME OF THE BREECHIN HAS BEEN INSTALLED. THE FGD WILL OPERATE IN A FULLY AUTOMATIC BASIS.
AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 10/76 EQUIPMENT: PROCESS CONTROL
END DATE 12/76 PROBLEM: NOT DEFINED/SPECIFIED
KP&L REPORTED THAT C-E HAS ENCOUNTERED SOME PROBLEMS WORKING OUT AND FINE TUNING SOME OF THE LOGIC CIRCUITS.
AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
11/76	SYSTEM							720			
12/76	SYSTEM							744			

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 1/77 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 5/77 COMMENTS:
KP&L REPORTED THAT CONSTRUCTION OF THE NEW SCRUBBING SYSTEM IS STILL IN PROGRESS. ALL FOUNDATION WORK HAS BEEN COMPLETED AND THE ERECTION OF THE STRUCTURAL STEEL AND BREECHING IS CONTINUING. THE MODULES ARE NOW BEING ERECTED AT THE PLANT SITE, PARALLEL TO THE EXISTING MARBLE-BED SYSTEM.
AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
1/77	SYSTEM							744			
2/77	SYSTEM							672			
3/77	SYSTEM							744			
4/77	SYSTEM							720			
5/77	SYSTEM							744			

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---------------------------------------PERFORMANCE DATA---------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION % REMOVAL    PER BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------

  6/77 SYSTEM                                                               720

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   6/77     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     7/77     COMMENTS:
                          OPERATION OF THE EXISTING MARBLE BED SCRUBBERS HAS BEEN QUITE SATISFACTORY
                          AND NEARLY PROBLEM FREE. THE CONNECTING DUCTWORK IS CURRENTLY BEING INSTAL
                          LED AS CONSTRUCTION CONTINUES. THE TWO PARALLEL SCRUBBING MODULES, EACH
                          DESIGNED TO HANDLE 200 MW OF GENERATING CAPACITY ARE INSTALLED, AS ARE
                          THE REHEATER TUBE BUNDLES. THE EXISTING MARBLE BED SCRUBBERS WILL BE
                          REMOVED WHEN THE NEW SCRUBBING SYSTEM IS READY FOR SO2 REMOVAL OPERATIONS.
             AFFECTED MODULES: SYSTEM

  7/77 SYSTEM                                                               744

  8/77 SYSTEM                                                               744

  9/77 SYSTEM                                                               720

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   9/77     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     9/77     COMMENTS:
                          THE CONSTRUCTION ON THE NEW SCRUPBER PLANT IS CONTINUING ACCORDING TO
                          SCHEDULE AND IS EXPECTED TO BE SCMPLETE BY APRIL 1978. KP&L INDICATED
                          THAT MORE DETAILED INFORMATION WOULD BE AVAILABLE FOR THE NEXT REPORT.
             AFFECTED MODULES: SYSTEM

 10/77 SYSTEM                                                               744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/77     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    11/77     COMMENTS:
                          THE SYSTEM OPERATED UNDER NORMAL CONDITIONS THROUGHOUT OCTOBER AND NOVEMBE
                          WITH NO PROBLEMS.
             AFFECTED MODULES: SYSTEM

 11/77 SYSTEM                                                               720

 12/77 SYSTEM                                                               744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  12/77     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     1/78     COMMENTS:
                          THE CONSTRUCTION OF TEO VENTRI-ROD SCRUBBERS IS NOW COMPLETE. THE INLET
                          DUCTWORK IS BEING INSTALLED, AND THE OUTLET DECTWORK WILL BE INSTALLED
                          ALONG WITH ADDITIONAL CONTROLS DURING THE SCHEDULED OUTAGE IN APRIL 1978,
                          HTE PRESENT FGD SYSTEM OPERATED WITHOUT ANY PROBLEMS.
             AFFECTED MODULES: SYSTEM

  1/78 SYSTEM                                                               744

  2/78 SYSTEM                                                               672

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   2/78     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     3/78     COMMENTS:
                          THE ORIGINAL FGD SYSTEM WAS PULLED OFF LINE ON MARCH 20 SO THAT THE NEW
                          SCRUBBER-ABSORBER SYSTEM COULD BE TIED INTO THE GAS PATH. THES NEW SYSTEM
                          CONSISTS OF TWO MODULES EACH WITH A ROD SCCTION FOR PARTICULATE REMOVAL
                          AND A SPRAY TOWER FOR SO2 REMOVAL. THE CAPACITY IS 210 MW EACH MODULE.
                          INITAL OPERATION SHOULD BEGIN BY THE FIRST OF MAY.
             AFFECTED MODULES: SYSTEM

  3/78 SYSTEM                                                               744

  4/78 SYSTEM                                                               720
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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-------------------------------------------PERFORMANCE DATA-------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   4/78     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     5/78     COMMENTS:
                         THE NEW UNIT WENT IN SERVICE ON ALRIL 14 AND HAS OPERATED WITH NO OUTAGES
                         SINCE START-UP.
            AFFECTED MODULES: SYSTEM

  5/78  SYSTEM                                                                 744

  6/78  SYSTEM                                                                 720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   6/78     EQUIPMENT: BOILER-RELATED
            END DATE     7/78
                         THE BOILER OPERATED ALL BUT TWO DAYS OF THE HUNE-HULY PERIOD, WHEN A BOILE
                         DRAIN LINE LEAK CAULSED AN OUTAGE.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   6/78     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     7/78     COMMENTS:
                         THE FGD SYSTEM OPERATED THE ENTIRE TIME THE BOILER WAS ON-LINE, WITH NO
                         REPORTED PROBLEMS.
            AFFECTED MODULES: SYSTEM

  7/78  SYSTEM                                                                 744

  8/78  SYSTEM                                                                 744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/78     EQUIPMENT: BOILER-RELATED
            END DATE     9/78
                         THE SYSTEM RAN WITH NO FORCED OUTAGES DURING THE AUGUST-SEPTEMBER PERIOD.
                         THE UNIT WAS TAKEN DOWN AT THE END OF SEPTEMBER FOR A SCHEDULED TWO WEEK
                         TURBINE/BOILER OUTAGE. TOUTINE MAINTANCE IS BEING PERFORMED ON THE BOILER
                         AND TURBINE
            AFFECTED MODULES: SYSTEM

  9/78  SYSTEM                                                                 720

 10/78  SYSTEM                                                                 744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/78     EQUIPMENT: BOILER-RELATED
            END DATE    11/78     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                         THE SYSTEM RAN THROUGHOUT THE PERIOD WITH ONLY ONE OUTAGE FOR AN ANNUAL
                         ONE-WEEK BOILER-TURBINE INPPECTION IN OCTOBER.
            AFFECTED MODULES: SYSTEM

 11/78  SYSTEM                                                                 720

 12/78  SYSTEM                                                                 744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/78     EQUIPMENT: PIPING
            END DATE     1/79     PROBLEM: COMPONENT FAILURE, OTHER
                         A 30 HOUR OUTAGE WAS REQUIRED DUE TO A RUPTURED PIPE.
            AFFECTED MODULES: SYSTEM

  1/79  SYSTEM                                                                 744
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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COMPANY NAME                                  KENTUCKY UTILITIES
PLANT NAME                                    GREEN RIVER
UNIT NUMBER                                   1-3
CITY                                          CENTRAL CITY
STATE                                         KENTUCKY
REGULATORY CLASSIFICATION                     C
PARTICULATE EMISSION LIMITATION - NG/J          42.          (  .097 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                 718.          ( 1.670 LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW            *******
GROSS UNIT GENERATING CAPACITY - MW             64.0
NET UNIT GENERATING CAPACITY W/FGD - MW         60.0
NET UNIT GENERATING CAPACITY WO/FGD - MW        62.0
EQUIVALENT SCRUBBED CAPACITY - MW               64.0

** BOILER DATA
     SUPPLIER                                 BABCOCK AND WILCOX
     TYPE                                     DRY BOTTOM, PULVERIZED COAL
     SERVICE LOAD                             PEAK
     COMMERCIAL SERVICE DATE                   0/50
     MAXIMUM BOILER FLUE GAS FLOW - CU.M/S      169.88        ( 360000 ACFM)
     FLUE GAS TEMPERATURE - C                  148.9         ( 300 F)
     STACK HEIGHT - M                           50.          ( 165 FT)
     STACK TOP DIAMETER - M                      4.9         ( 16.0 FT)

** FUEL DATA
     FUEL TYPE                                COAL
     FUEL GRADE                               BITUMINOUS
     AVERAGE HEAT CONTENT - KJ/KG              25586.        ( 11000 BTU/LB)
     RANGE HEAT CONTENT - BTU/LB                              ******
     AVERAGE ASH CONTENT - %                    13.40
     RANGE ASH CONTENT - %                    ******
     AVERAGE MOISTURE CONTENT - %               12.10
     RANGE MOISTURE CONTENT - %               ******
     AVERAGE SULFUR CONTENT - %                  4.00
     RANGE SULFUR CONTENT - %                 ******
     AVERAGE CHLORIDE CONTENT - %             ********
     RANGE CHLORIDE CONTENT - %               ******
     FUEL FIRING RATE - M T/H                 *******        (*** TPH)
     FUEL FIRING RATE - MW                    *****

** MECHANICAL COLLECTOR
     TYPE                                     CYCLONES
     SUPPLIER                                 WESTERN PRECIPITATION
     PARTICULATE DESIGN REMOVAL EFFICIENCY - %  85.0
     FLUE GAS CAPACITY - CU.M/S                 49.5         ( 105000 ACFM)
     PRESSURE DROP - KPA                          .5         (    2 IN-H2O)

** PARTICULATE SCRUBBER
     NUMBER                                    1
     TYPE                                     VARIABLE THROAT VENTURI
     SUPPLIER                                 AMERICAN AIR FILTER
     NUMBER OF STAGES                            1
     SHELL MATERIAL                           MILD STEEL
     LINING MATERIAL                          ACID PROOF PRECRETE
     INTERNAL MATERIAL                        STAINLESS STEEL THROAT
     TYPE OF NOZZLES                          SPINNER VANE
     BOILER LOAD/SCRUBBER - %                  100.0
     FLUE GAS CAPACITY - CU.M/S                136.0         ( 288200 ACFM)
     FLUE GAS TEMPERATURE - C                   52.2         (  126 F)
     LIQUID RECIRCULATION RATE - LITER/S        85.7         ( 1360 GPM)
     L/G RATIO - LITER/CU.M                      4.6         (34.5 GAL/1000ACF)
     PRESSURE DROP - KPA                         1.7         (    7 IN-H2O)
     PARTICULATE INLET LOAD - G/CU.M             5.0         (  2.20 GR/SCF)
     SO2 INLET CONCENTRATION - PPM            2200.000

** FGD SYSTEM
     SALEABLE PRODUCT/THROWAWAY PRODUCT       THROWAWAY PRODUCT
     GENERAL PROCESS TYPE                     WET SCRUBBING
     PROCESS TYPE                             LIME
     SYSTEM SUPPLIER                          AMERICAN AIR FILTER
     DEVELOPMENT LEVEL                        FULL-SCALE
     NEW/RETROFIT                             RETROFIT
     PARTICULATE DESIGN REMOVAL EFFICIENCY - %  99.50
     SO2 DESIGN REMOVAL EFFICIENCY - %          80.00
     COMMERCIAL DATE                           6/76
     INITIAL START-UP                          9/75
```

SECTION 3

DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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     CONSTRUCTION INITIATION                          4/74
     CONTRACT AWARDED                                 6/73

 ** ABSORBER
     NUMBER                                           1
     TYPE                                            MOBILE BED CONTACTOR
     INITIAL START UP                                 9/75
     SUPPLIER                                        AMERICAN AIR FILTER
     NUMBER OF STAGES                                   1
     DIMENSIONS                                      20X20X27.5
     SHELL MATERIAL                                  MILD STEEL
     SHELL LINER MATERIAL                            ACID PROOF REFRACTORY
     BOILER LOAD/ABSORBER - %                         100.0
     GAS FLOW - CU.M/S                                136.00        ( 288200 ACFM)
     GAS TEMPERATURE - C                               52.2         (  126 F)
     LIQUID RECIRCULATION RATE - LITER/S              614.          ( 9750 GPM)
     L/G RATIO - L/CU.M                                 4.5         ( 34.0 GAL/1000ACF)
     PRESSURE DROP - KPA                                1.0         ( 4.0 IN-H2O)
     SUPERFICAL GAS VELOCITY - M/SEC                    4.3         ( 14.0 FT/S)
     PARTICULATE OUTLET LOAD- G/CU.M                     .1         (  .044 GR/SCF)
     SO2 OUTLET CONTRATION - PPM                      400

 ** FANS
     TYPE                                            BOILER ID BOOSTER FAN
     CONSTRUCTION MATERIALS                          MILD STEEL

 ** MIST ELIMINATOR
     NUMBER                                           1
     TYPE                                            RADIAL VANE
     CONSTRUCTION MATERIAL                           STAINLESS STEEL VANES
     CONFIGURATION                                   HORIZONTAL
     NUMBER OF STAGES                                   1
     NUMBER OF PASSES                                   1
     FREEBOARD DISTANCE - M                             8.38       (27.5 FT)
     DEPTH - M                                           .91       ( 3.0 FT)
     WASH SYSTEM                                     OUTWARD SPRAY AT 50 GPM, CONTINUOUS
     SUPERFICIAL GAS VELOCITY - M/S                    7.6         ( 25.0 FT/S)
     PRESSURE DROP - KPA                                 .5        ( 2.0 IN-H2O)

 ** PROCESS CONTROL CHEMISTRY
     CONTROL VARIABLES                               SO2, GAS FLOW PRESSURE DROP, PH, PERCENT SOLIDS
     CONTROL RANGE                                   PH-5 TO 8.5; 10% SOLIDS IN RECYCLE
     SENSOR LOCATION                                 PH-REACTANT TANK; DENSITY METERS-RECYCLE LINE

 ** PUMPS
     SERVICE                                         NUMBER
     -------                                         ------
     RECYCLE                                            4
     RECIRCULATION                                      2
     RECIRCULATION (SPARE)                              1
     SLURRY TRANSFER                                    2
     POND WATER RETURN                                  2
     BLEED STREAM                                       2

 ** TANKS
     SERVICE                                         NUMBER
     -------                                         ------
     SLAKING TANK (SPARE)                               1
     SLAKED SLURRY DILUTION/HOLDING TANK             ****
     REACTION/RECYCLE                                   1
     SLAKING TANK                                       1

 ** REHEATER
     TYPE                                            IN-LINE
     HEATING MEDIUM                                  STEAM
     TEMPERATURE BOOST - C                             27.8         (   50 F)

 ** WATER LOOP
     TYPE                                            CLOSED
     FRESH MAKEUP WATER ADDITION - LITERS/S             4.7         (   75 GPM)

 ** DISPOSAL
     NATURE                                          FINAL
     TYPE                                            LINED POND
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    LOCATION                                            ON-SITE
    TRANSPORTATION                                      PIPE
    AREA - ACRES                                           7.4
    CAPACITY - CU.M                                     203629     (   166.5 ACRE-FT)


------------------------------------------PERFORMANCE DATA------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION % REMOVAL   PER BOILER  FGD    CAP.
                                                               SO2   PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

 9/75  SYSTEM                                                                720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    9/75      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE      1/76      COMMENTS:
                          THE SYSTEM BECAME OPERATIONAL SEPTEMBER 13, 1975 ON A HALF-LOAD BASIS
                          BECAUSE OF TURBINE OVERHAUL.  LOGGING OF OPERATING DATA BEGAN DECEMBER
                          1975.
            AFFECTED MODULES: SYSTEM

10/75  SYSTEM                                                                744

11/75  SYSTEM                                                                720

12/75  SYSTEM      74.0        65.0        78.0        35.0                  744   398    257

 1/76  SYSTEM      42.0        11.0        14.0         9.0                  744          640

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    1/76      EQUIPMENT: RECYCLE PUMP
            END DATE      1/76      PROBLEM: NOT DEFINED/SPECIFIED
                          A MAJOR PROBLEM WAS FAILURE OF THE RECYCLE PUMPS.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    1/76      EQUIPMENT: PIPING
            END DATE      1/76      PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                          THAWING AND REPAIR OF NUMEROUS FROZEN LINES WAS REQUIRED.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    1/76      EQUIPMENT: PUMP, OTHER
            END DATE      1/76      PROBLEM: NOT DEFINED/SPECIFIED
                          SHUTDOWN OF SUMP PUMPS WAS NECESSARY.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    1/76      EQUIPMENT: TANK, OTHER
            END DATE      1/76      PROBLEM: NOT DEFINED/SPECIFIED
                          A MAJOR PROBLEM AREA WAS THE FEED TANK AGITATOR.
            AFFECTED MODULES: SYSTEM

 2/76  SYSTEM      70.0        42.0        42.0        30.0                  696          211

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    2/76      EQUIPMENT: TANK, OTHER
            END DATE      2/76      PROBLEM: NOT DEFINED/SPECIFIED
                          REPAIRS WERE MADE TO THE TANK AGITATORS, SLAKE TANKS AND MIX-HOLD TANKS
                          CONTRIBUTING TO OUTAGE TIME.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    2/76      EQUIPMENT: RECYCLE PUMP
            END DATE      2/76      PROBLEM: NOT DEFINED/SPECIFIED
                          REPAIRS AND CLEANOUT OF REACTANT PUMPS CONTRIBUTATED TO OUTAGE TIME.
            AFFECTED MODULES: SYSTEM

 3/76  SYSTEM      97.0        85.0        95.0        52.0                  744          386

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    3/76      EQUIPMENT: PUMP, OTHER
            END DATE      3/76      PROBLEM: NOT DEFINED/SPECIFIED
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--------------------------------------------------PERFORMANCE DATA---------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART.  HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ---- -----  ----- -----  ----- ------
                        ALL RUBBER-LINED IMPELLERS WERE REPLACED IN THE PUMPS.
               AFFECTED MODULES: SYSTEM

 4/76  SYSTEM     90.0        100.0       100.0        77.0                  720           522

 5/76  SYSTEM     81.0        100.0       100.0        61.0                  744           456

 6/76  SYSTEM    100.0         99.0        99.0        82.0                  720           589

 7/76  SYSTEM     90.0         98.0        99.0        72.0                  744           574

 8/76  SYSTEM     97.0         97.0        97.0        97.0                  744    744    722

       ** PROBLEMS/SOLUTIONS/COMMENTS
               START DATE    8/76      EQUIPMENT: FAN
               END DATE      8/76      PROBLEM: DESIGN-RELATED VIBRATION
                                       VIBRATION IN THE SCRUBBER BOOSTER I.D. FAN NECESSITATED SYSTEM SHUTDOWN
                                       AND REPAIR.
               AFFECTED MODULES: SYSTEM

 9/76  SYSTEM     86.0        100.0       100.0        79.0                  720           571

       ** PROBLEMS/SOLUTIONS/COMMENTS
               START DATE    9/76      EQUIPMENT: FAN
               END DATE      9/76      PROBLEM: NOT DEFINED/SPECIFIED
                                       MINOR FAN PROBLEMS OCCURRED BUT NO FORCED OUTAGE TIME WAS REQUIRED.
               AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
               START DATE    9/76      EQUIPMENT: BOILER-RELATED
               END DATE      9/76      PROBLEM: NOT DEFINED/SPECIFIED
                                       HALF-LOAD OPERATIONS WERE CONDUCTED THROUGHOUT THE PERIOD BECAUSE OF
                                       BEARING PROBLEMS TO ONE OF THE TWO TURBINE GENERATING UNITS.
               AFFECTED MODULES: SYSTEM

10/76  SYSTEM    100.0        100.0       100.0        94.0                  744           699

11/76  SYSTEM    100.0        100.0        98.0        98.0                  720           704

       ** PROBLEMS/SOLUTIONS/COMMENTS
               START DATE   11/76      EQUIPMENT: ABSORBER
               END DATE     12/76      COMMENTS:
                                       DURING NOVEMBER AND DECEMBER, 1976 SOME FLUE GAS WAS BY-PASSED AROUND
                                       THE SYSTEM WHILE THE UTILITY CONDUCTED A CHECKOUT OF THE SCRUBBER INTERNAL
                                       AND REPLACED SOME OF THE PACKING SPHERES IN THE MOBILE BED.
               AFFECTED MODULES: SYSTEM

12/76  SYSTEM     73.0         97.0        87.0        70.0                  744           517

 1/77  SYSTEM     94.0         94.0        94.0        94.0                  744    744    698

       ** PROBLEMS/SOLUTIONS/COMMENTS
               START DATE    1/77      EQUIPMENT: ABSORBER
               END DATE      1/77      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                                       THE SCRUBBER WAS RELINED WITH PRECRETE, REPLACING THE ORIGINAL
                                       "CARBOLINE" WHICH SHOWED EXCESSIVE FLAKING
               AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
               START DATE    1/77      EQUIPMENT: STACK
               END DATE      1/77      PROBLEM: NOT DEFINED/SPECIFIED
                                       THE STACK WAS RELINED WITH PRECRETE.
               AFFECTED MODULES: SYSTEM

 2/77  SYSTEM     36.0         91.0        91.0        36.0                  672    266    243

       ** PROBLEMS/SOLUTIONS/COMMENTS
               START DATE    2/77      EQUIPMENT: STACK
               END DATE      3/77      PROBLEM: DESIGN-RELATED INFERIOR CONSTRUCTION MATERIAL
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------------------------------------------PERFORMANCE DATA--------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
                           DURING THE MONTH OF FEBRUARY IT WAS FOUND THAT THE CARBOLINE STACK LINER
                           WAS BADLY DETERIORATED.  SCRUBBER AND BOILER OPERATIONS WERE TERMINATED
                           UNTILL THE STACK LINING IS REPAIRED.  THE STACK WAS REPAIRED FIRST BY
                           WELDING A BACKUP METAL PLATE TO THE PORTIONS OF THE STACK WHERE PITTING
                           OCCURRED.  THE ENTIRE STACK WAS THEN LINED WITH REFRACTORY COATING CALLED
                           PRECRETE 6-B BY AAF.  THE REPAIRS WERE COMPLETED MARCH 7.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   2/77      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     2/77      COMMENTS:
                           THE BOILER IS NOT OPERATED WITHOUT THE SCRUBBER BECAUSE THERE IS NO ESP
                           FOR PARTICULATE CONTROL.
             AFFECTED MODULES: SYSTEM

 3/77  SYSTEM                                                                  744

 4/77  SYSTEM     40.0        98.0        98.0        23.0                     720   167   164

 5/77  SYSTEM     99.0        98.0        98.0        69.0                     744   527   513

 6/77  SYSTEM    100.0       100.0       100.0         5.0                     720   340   340

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   6/77      EQUIPMENT: SCRUBBER
             END DATE     6/77      PROBLEM: NOT DEFINED/SPECIFIED
                           WORK ON THE SCRUBBER MODULE CONCERNE REPAIRS TO THE UNDERBED DAMPER SYSTEM
                           AND LEAKING IN THE VENTURI.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   6/77      EQUIPMENT: REAGENT HANDLING
             END DATE     6/77      PROBLEM: NOT DEFINED/SPECIFIED
                           LIME SLAKING OPERATIONS WAS REPAIRED.
             AFFECTED MODULES: SYSTEM

 7/77  SYSTEM                                                                  744

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   7/77      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    11/77      COMMENTS:
                           A STRIKE BY PLANT OPERATING PERSONNEL RESULTED IN BOILER AND FGD SYSTEM
                           SHUTDOWN.
             AFFECTED MODULES: SYSTEM

 8/77  SYSTEM                                                                  744

 9/77  SYSTEM                                                                  720

10/77  SYSTEM                                                                  744

11/77  SYSTEM     86.0        91.0        91.0        41.0                     720   332   301

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  11/77      EQUIPMENT: RECYCLE PUMP
             END DATE    12/77      PROBLEM: NOT DEFINED/SPECIFIED
                           PROBLEMS WERE ENCOUNTERED WITH LEAKS IN RECYCLE PUMP IMPELLER COATINGS
                           AND PUMP FAILURES.  TWO PUMPS WERE DOWN AND BEING BYPASSED.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  11/77      EQUIPMENT: PIPING
             END DATE     2/78      PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                           DUE TO THE VERY COLD WEATHER NUMEROUS FREEZE-UPS OCCURED INCLUDING THE
                           SLURRY LINE TO THE POND CAUSING FGD OUTAGE.
             AFFECTED MODULES: SYSTEM
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-------------------------------------------PERFORMANCE DATA-----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS HOURS FACTOR
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        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  11/77     EQUIPMENT: PUMP, OTHER
              END DATE    11/77     PROBLEM: NOT DEFINED/SPECIFIED
                          SUMP PUMP FAILURES WERE NOTED.
              AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  11/77     EQUIPMENT: ABSORBER
              END DATE    11/77     PROBLEM: NOT DEFINED/SPECIFIED
                          LEAKS IN THE PACKING WERE NOTED.
              AFFECTED MODULES: SYSTEM

12/77  SYSTEM      50.0        63.0        91.0        50.0                     744   596   375

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  12/77     EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     1/78     COMMENTS:
                          THE SYSTEM COULD HAVE BEEN CONSIDERED AVAILABLE THROUGHOUT MOST OF THE
                          PERIOD BUT BECAUSE EMERGENCY CONDITIONS THE UTILITY CHOSE TO CONCENTRATE
                          THEIR MAINTENANCE CREWS ON POWER GENERATION RATHER THAN FGD OPERATION.
                          UNDER NORMAL CONDITIONS THE RELATIVELY MINOR FGD SYSTEM PROBLEMS WOULD
                          HAVE BEEN SOLVED MORE QUICKLY.
              AFFECTED MODULES: SYSTEM

 1/78  SYSTEM      31.0        32.0        32.0        23.0                     744   537   170

 2/78  SYSTEM     100.0                                                         672   672

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   2/78     EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     4/78     PROBLEM: NOT DEFINED/SPECIFIED
                          DURING THE FREEZE UP NUMEROUS GASKETS WERE TORN THROUGHOUT THE SYSTEM.
                          THE SYSTEM WAS SHUT DOWN COMPLETELY FOR REPAIR WORK.
              AFFECTED MODULES: SYSTEM

 3/78  SYSTEM     100.0                                                         744   669

 4/78  SYSTEM      41.0        99.0        99.0        41.0                     720   295   296

 5/78  SYSTEM      64.0       100.0       100.0        64.0                     744   474   474

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   5/78     EQUIPMENT: PUMP, OTHER
              END DATE     5/78     PROBLEM: PLUGGING, OTHER
                          THE SCREENS ON THE SUCTION SIDE OF THE PUMPS THAT PUMP THE SLURRY FROM THE
                          PREP ROOM TO THE NOZZLES EXPERIENCED PLUGGING PROBLEMS. THE SCREENS GET
                          PLUGGED WITH LARGE GRIT IN THE SLURRY AND ARE SUCKED OUT OF POSITION BY
                          THE PUMPS.  THE UTILITY REPORTED THAT THIS TENDS TO BE A RE-OCCURRING
                          PROBLEM.
              AFFECTED MODULES: SYSTEM

 6/78  SYSTEM      73.0       100.0       100.0        73.0                     720   525   524

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   6/78     EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     7/78     PROBLEM: NOT DEFINED/SPECIFIED
                          BOILER AND FGD SYSTEM OUTAGES DURING JUNE AND JULY WERE FOR ROUTINE
                          MAINTENANCE.
              AFFECTED MODULES: SYSTEM

 7/78  SYSTEM      13.0        96.0       100.0        13.0                     744   103    99

 8/78  SYSTEM      61.0        99.0        99.0        28.0                     744   207   205

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   8/78     EQUIPMENT: PUMP, OTHER
              END DATE     8/78     PROBLEM: NOT DEFINED/SPECIFIED
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-------------------------------------------PERFORMANCE DATA--------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
                     THE UNIT WAS DOWN FROM AUGUST 1 UNTILL AUGUST 12 AS A RESULT OF BLEED
                     PUMP PROBLEMS.
           AFFECTED MODULES: SYSTEM

 9/78  SYSTEM      76.0        98.0       100.0        41.0                     720   303    298

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   9/78      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE     9/78      PROBLEM: PLUGGING, OTHER
                     BECAUSE OF PLUGGING PROBLEMS THE FGD SYSTEM WAS OPERATED AT APPROXIMATELY
                     ONE THIRD OF TOTAL CAPACITY THROUGHOUT SEPTEMBER.
           AFFECTED MODULES: SYSTEM

10/78  SYSTEM      30.0        94.0        96.0        30.0                     744   236    222

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE  10/78      EQUIPMENT: RECYCLE TANK
           END DATE    10/78      PROBLEM: PLUGGING, OTHER
                     THE FGD SYSTEM EXPERIENCED RECYCLE TANK SCREEN PLUGGING.
           AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE  10/78      EQUIPMENT: FAN
           END DATE    10/78      PROBLEM: NOT DEFINED/SPECIFIED
                     THE FGD SYSTEM EXPERIENCED VIBRATING FAN PROBLEMS.
           AFFECTED MODULES: SYSTEM

11/78  SYSTEM      24.0       100.0        74.0        24.0                     720   175    175

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE  11/78      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE    11/78      COMMENTS:
                     THE UNIT WAS DOWN THE LAST TWO WEEKS OF NOVEMBER DUE TO LOW LOAD DEMAND.
           AFFECTED MODULES: SYSTEM

12/78  SYSTEM                                                                   744

 1/79  SYSTEM                                                                   672
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

COMPANY NAME	LOUISVILLE GAS & ELECTRIC	
PLANT NAME	CANE RUN	
UNIT NUMBER	4	
CITY	LOUISVILLE	
STATE	KENTUCKY	
REGULATORY CLASSIFICATION	A	
PARTICULATE EMISSION LIMITATION - NG/J	******	(****** LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J	******	(****** LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW	992.0	
GROSS UNIT GENERATING CAPACITY - MW	190.0	
NET UNIT GENERATING CAPACITY W/FGD - MW	182.0	
NET UNIT GENERATING CAPACITY WO/FGD - MW	185.0	
EQUIVALENT SCRUBBED CAPACITY - MW	190.0	
** BOILER DATA		
SUPPLIER	COMBUSTION ENGINEERING	
TYPE	PULVERIZED COAL	
SERVICE LOAD	BASE	
COMMERCIAL SERVICE DATE	**/**	
MAXIMUM BOILER FLUE GAS FLOW - CU.M/S	346.37	(734000 ACFM)
FLUE GAS TEMPERATURE - C	160.0	(320 F)
STACK HEIGHT - M	76.	(250 FT)
STACK TOP DIAMETER - M	*******	(***** FT)
** FUEL DATA		
FUEL TYPE	COAL	
FUEL GRADE	******	
AVERAGE HEAT CONTENT - KJ/KG	26749.	(11500 BTU/LB)
RANGE HEAT CONTENT - BTU/LB		******
AVERAGE ASH CONTENT - %	********	
RANGE ASH CONTENT - %	15-16	
AVERAGE MOISTURE CONTENT - %	********	
RANGE MOISTURE CONTENT - %	******	
AVERAGE SULFUR CONTENT - %	3.75	
RANGE SULFUR CONTENT - %	3.5-4.0	
AVERAGE CHLORIDE CONTENT - %	********	
RANGE CHLORIDE CONTENT - %	******	
FUEL FIRING RATE - M T/H	*******	(*** TPH)
FUEL FIRING RATE - MW	*****	
** ESP		
PARTICULATE DESIGN REMOVAL EFFICIENCY - %	99.0	
** FGD SYSTEM		
SALEABLE PRODUCT/THROWAWAY PRODUCT	THROWAWAY PRODUCT	
GENERAL PROCESS TYPE	WET SCRUBBING	
PROCESS TYPE	LIME	
PROCESS ADDITIVES	CARBIDE	
SYSTEM SUPPLIER	AMERICAN AIR FILTER	
DEVELOPMENT LEVEL	FULL-SCALE	
NEW/RETROFIT	RETROFIT	
PARTICULATE DESIGN REMOVAL EFFICIENCY - %	99.00	
SO2 DESIGN REMOVAL EFFICIENCY - %	85.00	
COMMERCIAL DATE	9/77	
INITIAL START-UP	8/76	
CONSTRUCTION INITIATION	10/74	
CONTRACT AWARDED	4/74	
** ABSORBER		
NUMBER	2	
TYPE	MOBILE BED (PARALLEL)	
INITIAL START UP	8/76	
SUPPLIER	AMERICAN AIR FILTER	
SHELL LINER MATERIAL	PRECRETE AND PLACITE 4005	
L/G RATIO - L/CU.M	8.0	(60.0 GAL/1000ACF)
SO2 DESIGN REMOVAL EFFICIENCY - %	87.5	
** FANS		
TYPE	ID BOOSTER	
** MIST ELIMINATOR		
NUMBER	4	
TYPE	CHEVRON	
CONSTRUCTION MATERIAL	PLASITE 4005 LINING	

** TANKS

SERVICE	NUMBER
REACTANT-RECYCLE	****

** REHEATER
TYPE DIRECT COMBUSTION
TEMPERATURE BOOST - C 27.8 (50 F)

** THICKENER
DIAMETER - M 22.9 (75 FT)

** WATER LOOP
TYPE OPEN
FRESH MAKEUP WATER ADDITION - LITERS/S 6.3 (100 GPM)

** DISPOSAL
NATURE FINAL
TYPE LINED POND
LOCATION ON SITE

PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
8/76	SYSTEM		90.0		90.0	87.50		744	740		

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 8/76 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 8/76 PROBLEM: NOT DEFINED/SPECIFIED
OUTAGE TIME DURING THE MONTH WAS DUE PRIMARILY TO EQUIPMENT INSPECTIONS, REPAIR/REPLACEMENT OF AUXILIARY MOTOR PARTS, AND DEPLETION OF ABSORBENT SUPPLY BECAUSE OF A LATE BARGE DELIVERY.
AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 8/76 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 8/76 COMMENTS:
THE SCRUBBING SYSTEM HAS BEEN GENERALLY OPERATING AT APPROXIMATELY 50 TO 80 PERCENT FLUE GAS CAPACITY.
AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 8/76 EQUIPMENT: AUXILIARY EQUIPMENT
END DATE 8/76 PROBLEM: NOT DEFINED/SPECIFIED
SOME MINOR PROBLEMS HAVE BEEN ENCOUNTERED WITH AUXILIARY EQUIPMENT MOTORS.
AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 8/76 EQUIPMENT: SPRAY NOZZLES
END DATE 8/76 PROBLEM: NOT DEFINED/SPECIFIED
SOME MINOR PROBLEMS HAVE BEEN ENCOUNTERED WITH SPRAY NOZZLES IN THE MOBILE BED CONTACTOR. THE SPRAY NOZZLES ARE SPINNER-VANE COMPONENTS ORIGINALLY CONSTRUCTED OF PLASTIC. OPERATING TEMPERATURES AND PRESSURES HAVE CAUSED THE PLASTIC HOUSING TO EXPAND RESULTING IN THE VANES EXTRUDING OUT THE FRONT END, SUBSEQUENTLY CAUSING A BLOCKAGE OF THE SLURRY FEED. THE NOZZLE HAVE BEEN REPLACED WITH CERAMIC CONSTRUCTED COMPONENTS.
AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
9/76	SYSTEM		90.0		90.0			720	720		
10/76	SYSTEM		90.0		73.0			744			

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 10/76 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 10/76 PROBLEM: NOT DEFINED/SPECIFIED
THE UNIT WAS TAKEN OUT OF SERVICE ON OCTOBER 25, 1976 TO IMPLEMENT ADDITIONAL MODIFICATIONS TO THE SCRUBBING SYSTEM. MAJOR SYSTEM MODIFICATIONS INCLUDE INCREASING PUMP CAPACITY AND DECREASING PRESSURE DROP. THESE TWO PROBLEMS HAVE HINDERED OPERATION OF THE UNIT AT FULL LOAD

```
------------------------------------------PERFORMANCE DATA------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
                           CAPACITY.
               AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
               START DATE  10/76     EQUIPMENT: FGD SYSTEM, GENERAL
               END DATE    10/76     COMMENTS:
                           TO DATE, THE MECHANICAL RELIABILITY OF THE SYSTEM AS A FUNCTION OF
                           SERVICE TIME VERSUS OUTAGE TIME, HAS BEEN VERY GOOD.
               AFFECTED MODULES: SYSTEM

 11/76  SYSTEM                  95.0                                         720

 12/76  SYSTEM                  90.0                                         744

  1/77
        SYSTEM                                                               744

          ** PROBLEMS/SOLUTIONS/COMMENTS
               START DATE   1/77     EQUIPMENT: FGD SYSTEM, GENERAL
               END DATE     3/77     COMMENTS:
                           DUE TO OHIO RIVER FREEZE UP BARGE DELIVERIES OF LIME CEASED.
               AFFECTED MODULES: SYSTEM

  2/77
        SYSTEM                                                               672

          ** PROBLEMS/SOLUTIONS/COMMENTS
               START DATE   2/77     EQUIPMENT: FGD SYSTEM, GENERAL
               END DATE     2/77     COMMENTS:
                           DURING FEBRUARY, THE SCRUBBER WAS ONLY OPERATED FOR TWO 4-HOUR PERIODS
                           TO PREVENT TOTAL FREEZE-UP.
               AFFECTED MODULES: SYSTEM

  3/77  SYSTEM                  83.0                    83.0                 744   432

          ** PROBLEMS/SOLUTIONS/COMMENTS
               START DATE   3/77     EQUIPMENT: FGD SYSTEM, GENERAL
               END DATE     3/77     COMMENTS:
                           THE SCRUBBER CAME BACK ON-LINE ON MARCH 14, 1977.
               AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
               START DATE   3/77     EQUIPMENT: GAS DAMPER
               END DATE     3/77     PROBLEM: NOT DEFINED/SPECIFIED
                           DC POWER SUPPLY TO THE BYPASS DAMPER FAILED.  THE SCRUBBER SYSTEM WAS
                           BYPASSED WHILE REPAIRS WERE MADE.
               AFFECTED MODULES: SYSTEM

  4/77
        SYSTEM                                                               720

          ** PROBLEMS/SOLUTIONS/COMMENTS
               START DATE   4/77     EQUIPMENT: FGD SYSTEM, GENERAL
               END DATE     7/77     COMMENTS:
                           THE SCRUBBING SYSTEM WAS DOWN FOR MODIFICATIONS FROM APRIL 18 TO JULY 17,
                           1977.
               AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
               START DATE   4/77     EQUIPMENT: MIST ELIMINATOR
               END DATE     7/77     PROBLEM: NOT DEFINED/SPECIFIED
                           A CHEVRON TYPE MIST ELIMINATOR WAS INSTALLED DURING THE OUTAGE
               AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
               START DATE   4/77     EQUIPMENT: PIPING
               END DATE     7/77     PROBLEM: NOT DEFINED/SPECIFIED
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-----------------------------------------PERFORMANCE DATA------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION % REMOVAL   PER  BOILER  FGD   CAP.
                                                               SO2 PART.   HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
                          A NEW SPRAY HEADER WAS ADDED TO INCREASE THE L/G RATIO DURING THE OUTAGE.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   4/77     EQUIPMENT: RECYCLE TANK
             END DATE     7/77     PROBLEM: NOT DEFINED/SPECIFIED
                          DIRECT OIL-FIRED REHEAT WAS ADDED DURING THE OUTAGE.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   4/77     EQUIPMENT: DUCTWORK
             END DATE     7/77     PROBLEM: DESIGN-RELATED INFERIOR CONSTRUCTION MATERIAL
                          THE LINING IN THE SYSTEM FROM THE MIST ELIMINATOR TO THE STACK WAS REPLACE
                          WITH PLASITE 4005 (THE ORIGINAL LINING WAS BUBBLING, BUT HAD NOT YET
                          FAILED, FAILURE SEEMED IMMINENT WITHIN 4-5 MONTHS).  THE NEW LINING WAS
                          INSTALLED BY GENERAL COATINGS.
             AFFECTED MODULES: SYSTEM

 5/77
       SYSTEM                                                               744

 6/77
       SYSTEM                                                               720

 7/77 SYSTEM                   90.0                   43.6                  744   360

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   7/77     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     7/77     COMMENTS:
                          THE SYSTEM WAS PLACED BACK IN SERVICE ON JULY 17, 1977 AFTER SYSTEM
                          MODIFICATIONS WERE COMPLETED.
             AFFECTED MODULES: SYSTEM

 8/77 SYSTEM                   94.0                   93.0                  744   657

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   8/77     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     9/77     COMMENTS:
                          COMPLIANCE TESTING OCCURED DURING AUGUST AND SEPTEMBER 1977 BY EPA
                          PERSONNEL AND WAS OFFICIALLY APPROVED TO HAVE ACHIEVED COMPLIANCE.
             AFFECTED MODULES: SYSTEM

 9/77 SYSTEM                   99.0                   99.0                  720   529

10/77 SYSTEM                   98.0                   89.0                  744   677

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/77     EQUIPMENT: REAGENT HANDLING
             END DATE    10/77
                          DURING DECEMBER, "AIRCO", THE LIME SUPPLIER, HAD 1200 FT OF THEIR FEED
                          LINE FREEZE UP.
             AFFECTED MODULES: SYSTEM

11/77 SYSTEM                   94.0                   63.0                  720   483

12/77 SYSTEM                   85.0                   82.0                  744   715

 1/78 SYSTEM                   67.0                   67.0                  744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   1/78     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     1/78     COMMENTS:
                          LINE BECAME UNAVAILABLE FOR A TIME BUT THERE WERE NO SCRUBBER BREAKDOWNS.
             AFFECTED MODULES: SYSTEM

 2/78
       SYSTEM                                                               672
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------------------------------------------PERFORMANCE DATA------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL    PER BOILER  FGD    CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   2/78     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     3/78     COMMENTS:
                          THE UNIT WAS DOWN THE ENTIRE MONTH OF FEBRUARY DUE TO A COAL SHORTAGE
                          AND A LACK OF AVAILABLE LIME RESULTING FROM THE SEVERE WINTER WEATHER.
                          THE UNIT CAME BACK ON LINE MARCH 21, 1978.
             AFFECTED MODULES: SYSTEM

 3/78  SYSTEM                                          34.0                  744

 4/78  SYSTEM                 100.0                    47.0                  744  303

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   4/78     EQUIPMENT: BOILER-RELATED
             END DATE     4/78     PROBLEM: NOT DEFINED/SPECIFIED
                          DURING APRIL THE BOILER WAS DOWN FOR REPAIRS.
             AFFECTED MODULES: SYSTEM

 5/78  SYSTEM     31.0         35.0        35.0        12.0                  744  352

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   5/78     EQUIPMENT: BOILER-RELATED
             END DATE     5/78     PROBLEM: NOT DEFINED/SPECIFIED
                          THE BOILER WAS DOWN AGAIN IN MAY FOR REPAIRS.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   5/78     EQUIPMENT: GAS DAMPER
             END DATE     5/78     PROBLEM: NOT DEFINED/SPECIFIED
                          DURING THE MAY BOILER OUTAGE A NUMBER OF MODIFICATIONS WERE MADE TO THE
                          DAMPERS IN THE FGD SYSTEM.
             AFFECTED MODULES: SYSTEM

 6/78  SYSTEM                  99.0                    99.0                  720  720

 7/78  SYSTEM                  99.0                    91.0                  744  687

 8/78  SYSTEM                  94.0                    94.0                  744  744

 9/78  SYSTEM                 100.0                    19.0                  720  138

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   9/78     EQUIPMENT: BOILER-RELATED
             END DATE    11/78     PROBLEM: NOT DEFINED/SPECIFIED
                          THE BOILER WAS DOWN IN SEPTEMBER TO NOVEMBER 1978 FOR TUBE REPAIRS.
             AFFECTED MODULES: SYSTEM

10/78
       SYSTEM                                                                744

11/78  SYSTEM                  97.0                    58.0                  720  432

12/78
       SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  12/78     EQUIPMENT: BOILER-RELATED
             END DATE     1/79     PROBLEM: NOT DEFINED/SPECIFIED
                          DURING THIS PERIOD A TURBINE BECAME UNOPERATIONAL.  THE UNIT IS EXPECTED T
                          BE OFF LINE UATIL APRIL.
             AFFECTED MODULES: SYSTEM

 1/79
       SYSTEM                                                                744
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                                   SECTION 3
                 DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
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COMPANY NAME                                    LOUISVILLE GAS & ELECTRIC
PLANT NAME                                      CANE RUN
UNIT NUMBER                                     5
CITY                                            LOUISVILLE
STATE                                           KENTUCKY
REGULATORY CLASSIFICATION                       A
PARTICULATE EMISSION LIMITATION - NG/J          ******        (****** LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                  ******        (****** LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW                992.0
GROSS UNIT GENERATING CAPACITY - MW               200.0
NET UNIT GENERATING CAPACITY W/FGD - MW           192.0
NET UNIT GENERATING CAPACITY WO/FGD - MW          195.0
EQUIVALENT SCRUBBED CAPACITY - MW                 200.0

** BOILER DATA
    SUPPLIER                                    RILEY STOKER
    TYPE                                        PULVERIZED COAL
    SERVICE LOAD                                BASE
    COMMERCIAL SERVICE DATE                     **/**
    MAXIMUM BOILER FLUE GAS FLOW - CU.M/S         330.33      ( 700000 ACFM)
    FLUE GAS TEMPERATURE - C                      154.4       ( 310 F)
    STACK HEIGHT - M                            ******        (**** FT)
    STACK TOP DIAMETER - M                      *******       (***** FT)

** FUEL DATA
    FUEL TYPE                                   COAL
    FUEL GRADE                                  BITUMINOUS
    AVERAGE HEAT CONTENT - KJ/KG                 26749.       ( 11500 BTU/LB)
    RANGE HEAT CONTENT - BTU/LB                                ******
    AVERAGE ASH CONTENT - %                     ********
    RANGE ASH CONTENT - %                       15-16
    AVERAGE MOISTURE CONTENT - %                ********
    RANGE MOISTURE CONTENT - %                  ******
    AVERAGE SULFUR CONTENT - %                      3.75
    RANGE SULFUR CONTENT - %                    3.5-4.0
    AVERAGE CHLORIDE CONTENT - %                ********
    RANGE CHLORIDE CONTENT - %                  ******
    FUEL FIRING RATE - M T/H                    *******       (*** TPH)
    FUEL FIRING RATE - MW                       *****

** ESP

** FGD SYSTEM
    SALEABLE PRODUCT/THROWAWAY PRODUCT          THROWAWAY PRODUCT
    GENERAL PROCESS TYPE                        WET SCRUBBING
    PROCESS TYPE                                LIME
    PROCESS ADDITIVES                           CARBIDE
    SYSTEM SUPPLIER                             COMBUSTION ENGINEERING
    DEVELOPMENT LEVEL                           FULL-SCALE
    NEW/RETROFIT                                RETROFIT
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %      99.00
    SO2 DESIGN REMOVAL EFFICIENCY - %              85.00
    COMMERCIAL DATE                              6/78
    INITIAL START-UP                            12/77
    CONSTRUCTION INITIATION                     10/75
    CONTRACT AWARDED                             4/75

** ABSORBER
    NUMBER                                       2
    TYPE                                        SPRAY TOWER
    INITIAL START UP                            12/77

** REHEATER
    TYPE                                        IN LINE
    HEATING MEDIUM                              STEAM
    TEMPERATURE BOOST - C                          22.2       (   40 F)

** THICKENER
    NUMBER                                       1

** WATER LOOP
    TYPE                                        OPEN

** TREATMENT
    CONTRACTOR                                  IUCS
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                                                    SECTION 3
                                  DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
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 ** DISPOSAL
      NATURE                                         FINAL
      TYPE                                           LINED POND
      LOCATION                                       ON SITE

---------------------------------------- PERFORMANCE DATA -----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION % REMOVAL  PER  BOILER  FGD   CAP.
                                                               SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
12/77  SYSTEM
                                                                            744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  12/77     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    12/77     COMMENTS:
                         OPERATION OF THE FGD SYSTEM BEGAN ON DECEMBER 29, 1977.  INITIAL OPERA
                         TIONS WERE NOT CONTINUOUS.
             AFFECTED MODULES: SYSTEM

 1/78  SYSTEM
                                                                            744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   1/78     EQUIPMENT: INSTRUMENTATION
             END DATE     1/78     PROBLEM: NOT DEFINED/SPECIFIED
                         SOME OF THE CONTROLS WERE NOT WORKING PROPERLY AND MODIFI3ATIONS WERE
                         NECESSARY.
             AFFECTED MODULES: SYSTEM

 2/78  SYSTEM
                                                                            672

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   2/78     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     3/78     PROBLEM: NOT DEFINED/SPECIFIED
                         THE PLANT REMAINED OFF LINE THROUGHOUT FEBRUARY AND RESTARTED ON MARCH 24.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   2/78     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     3/78     PROBLEM: NOT DEFINED/SPECIFIED
                         VARIOUS INITIAL STAR-UP PROBLEMS WERE STILL BEING ENCOUNTERED CAUSING
                         FGD SYSTEM OUTAGES.
             AFFECTED MODULES: SYSTEM

 3/78  SYSTEM               50.0                     12.2                       744   182

 4/78  SYSTEM               97.0                     90.0                       720   669

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   4/78     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     5/78     COMMENTS:
                         FGD SYSTEM MODIFICATIONS WERE MADE DURING THIS TIME IN PREPAR1T90N FOR
                         PERFORMANCE TESTS.  HOWEVER THE EPA TEST METHODS WERE NOT FOLLOWED
                         ACCURATELY.
             AFFECTED MODULES: SYSTEM

 5/78  SYSTEM               84.0                     49.0                       744   432

 6/78  SYSTEM               86.0                     82.0                       720   685

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   6/78     EQUIPMENT: REAGENT HANDLING
             END DATE     7/78     PROBLEM: DESIGN-RELATED INFERIOR CONSTRUCTION MATERIAL
                         THE STEAM REHEAT COIL INSTALLATION HAS BEEN A CHRONIC PROBL5M AREA.  WELDS
                         HAVE BEEN FAILING EVER SINCE INITIAL OPERATIONS.
             AFFECTED MODULES: SYSTEM

 7/78  SYSTEM               80.0                     68.0                       744   632

 8/78  SYSTEM               86.0                     62.0                       744   540

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   8/78     EQUIPMENT: REAGENT HANDLING
             END DATE     9/78     PROBLEM: DESIGN-RELATED INFERIOR CONSTRUCTION MATERIAL
```

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--------------------------------------------PERFORMANCE DATA------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                      PROBLEMS CONTINUED WITH THE REHEAT COILS.
            AFFECTED MODULES: A

 9/78  SYSTEM                 80.0                    67.0                     720   609

10/78  SYSTEM                 96.0                    71.0                     744   530

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/78     EQUIPMENT: REAGENT HANDLING
            END DATE    11/78     PROBLEM: DESIGN-RELATED INFERIOR CONSTRUCTION MATERIAL
                      THE SYSTEM WAS SHUTDOWN FOR REPAIRS TO THE STEAM REHEATER COILS.  THE
                      OUTAGE LASTED ABOUT TWO WEEKS.
            AFFECTED MODULES: SYSTEM

11/78  SYSTEM                 94.0                    33.0                     720   253

12/78  SYSTEM      54.7       46.2        46.2        40.6                     744   654    302

 1/79  SYSTEM      69.6       67.4        67.4        62.8                     744   693    467
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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COMPANY NAME                                   LOUISVILLE GAS & ELECTRIC
PLANT NAME                                     MILL CREEK
UNIT NUMBER                                    3
CITY                                           LOUISVILLE
STATE                                          KENTUCKY
REGULATORY CLASSIFICATION                      B
PARTICULATE EMISSION LIMITATION - NG/J         *******         (****** LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                 *******         (****** LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW             ********
GROSS UNIT GENERATING CAPACITY - MW              425.0
NET UNIT GENERATING CAPACITY W/FGD - MW          425.0
NET UNIT GENERATING CAPACITY WO/FGD - MW       ********
EQUIVALENT SCRUBBED CAPACITY - MW                425.0

** BOILER DATA
    SUPPLIER                                   BABCOCK AND WILCOX
    TYPE                                       PULVERIZED COAL
    SERVICE LOAD                               BASE
    COMMERCIAL SERVICE DATE                    **/**
    MAXIMUM BOILER FLUE GAS FLOW - CU.M/S      *********       (******* ACFM)
    FLUE GAS TEMPERATURE - C                   ********        (**** F)
    STACK HEIGHT - M                           *******         (**** FT)
    STACK TOP DIAMETER - M                     ********        (***** FT)

** FUEL DATA
    FUEL TYPE                                  COAL
    FUEL GRADE                                 BITUMINOUS
    AVERAGE HEAT CONTENT - KJ/KG                26749.         ( 11500 BTU/LB)
    RANGE HEAT CONTENT - BTU/LB                                  ******
    AVERAGE ASH CONTENT - %                        11.50
    RANGE ASH CONTENT - %                      ******
    AVERAGE MOISTURE CONTENT - %               *********
    RANGE MOISTURE CONTENT - %                 3.75
    AVERAGE SULFUR CONTENT - %                      3.75
    RANGE SULFUR CONTENT - %                   3.5-4.0
    AVERAGE CHLORIDE CONTENT - %               *********
    RANGE CHLORIDE CONTENT - %                 *******
    FUEL FIRING RATE - M T/H                   ********        (*** TPH)
    FUEL FIRING RATE - MW                      *****

** ESP
    NUMBER                                      1

** FGD SYSTEM
    SALEABLE PRODUCT/THROWAWAY PRODUCT         THROWAWAY PRODUCT
    GENERAL PROCESS TYPE                       WET SCRUBBING
    PROCESS TYPE                               LIME
    PROCESS ADDITIVES                          CARBIDE
    SYSTEM SUPPLIER                            AMERICAN AIR FILTER
    DEVELOPMENT LEVEL                          FULL-SCALE
    NEW/RETROFIT                               NEW
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %     99.00
    SO2 DESIGN REMOVAL EFFICIENCY - %             85.00
    INITIAL START-UP                            8/78

** ABSORBER
    NUMBER                                      4
    TYPE                                       MOBILE BED SPRAY TOWER
    INITIAL START UP                            8/78
    SHELL MATERIAL                             CARBON STEEL
    SHELL LINER MATERIAL                       PRECRETE

** REHEATER
    HEATING MEDIUM                             STEAM

** WATER LOOP
    TYPE                                       OPEN
    FRESH MAKEUP WATER ADDITION - LITERS/S         9.4         (  150 GPM)

** TREATMENT
    TYPE                                       FLYASH AND LIME STABILIZED

** DISPOSAL
    NATURE                                     FINAL
    TYPE                                       SLUDGE POND
```

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----------------------------------------------PERFORMANCE DATA---------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD    CAP.
                                                                SO2  PART. HOURS HOURS  HOURS  FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------

 8/78
       SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    8/78      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE      8/78      COMMENTS:
                         OPERATION BEGAN ON AUGUST 13, 1978.
             AFFECTED MODULES: SYSTEM

 9/78  SYSTEM                  81.0                    80.0                  720   714

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    9/78      EQUIPMENT: PIPING
             END DATE      9/78      PROBLEM: NOT DEFINED/SPECIFIED
                         FRP PIPING PROBLEMS WERE ENCOUNTERED.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    9/78      EQUIPMENT:
             END DATE      9/78
                         PUMP PROBLEMS WERE RELATED TO BEARING AND SHAFT FAILURES.
             AFFECTED MODULES: SYSTEM

10/78  SYSTEM                  84.0                    81.0                  744   710

11/78  SYSTEM                  85.0                    42.0                  720   351

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   11/78      EQUIPMENT: BOILER-RELATED
             END DATE     11/78      COMMENT: PREVENTIVE MAINTENANCE
                         THE UNIT WAS SHUT DOWN NOVEMBER 18, 1978 FOR SCHDULED INSPECTION.  RESTART
                         IS PROJECTED FOR FEBRUARY 1, 1979.
             AFFECTED MODULES: SYSTEM

12/78

       SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   12/78      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE      1/79      COMMENTS:
                         THE UNIT DID NOT OPERATE DURING DECEMBER OR JANUARY.
             AFFECTED MODULES: SYSTEM

 1/79

       SYSTEM                                                                744
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 COMPANY NAME                                   LOUISVILLE GAS & ELECTRIC
 PLANT NAME                                     PADDY'S RUN
 UNIT NUMBER                                    6
 CITY                                           LOUISVILLE
 STATE                                          KENTUCKY
 REGULATORY CLASSIFICATION                      C
 PARTICULATE EMISSION LIMITATION - NG/J           43.         (  .100 LB/MMBTU)
 SO2 EMISSION LIMITATION - NG/J                  516.         ( 1.200 LB/MMBTU)
 NET PLANT GENERATING CAPACITY - MW             *******
 GROSS UNIT GENERATING CAPACITY - MW              70.0
 NET UNIT GENERATING CAPACITY W/FGD - MW          64.0
 NET UNIT GENERATING CAPACITY WO/FGD - MW         65.0
 EQUIVALENT SCRUBBED CAPACITY - MW                70.0

 ** BOILER DATA
    SUPPLIER                                    FOSTER WHEELER
    TYPE                                        DRY BOTTOM, PULVERIZED COAL
    SERVICE LOAD                                SUMMER PEAKING LOAD
    COMMERCIAL SERVICE DATE                      0/51
    MAXIMUM BOILER FLUE GAS FLOW - CU.M/S         188.76       ( 400000 ACFM)
    FLUE GAS TEMPERATURE - C                      179.4        ( 355 F)
    STACK HEIGHT - M                               76.         ( 250 FT)
    STACK TOP DIAMETER - M                      *******        (***** FT)

 ** FUEL DATA
    FUEL TYPE                                   COAL
    FUEL GRADE                                  ******
    AVERAGE HEAT CONTENT - KJ/KG                 26749.        ( 11500 BTU/LB)
    RANGE HEAT CONTENT - BTU/LB                                  ******
    AVERAGE ASH CONTENT - %                        11.50
    RANGE ASH CONTENT - %                       ******
    AVERAGE MOISTURE CONTENT - %                ********
    RANGE MOISTURE CONTENT - %                  ******
    AVERAGE SULFUR CONTENT - %                      2.50
    RANGE SULFUR CONTENT - %                    2.0-3.5
    AVERAGE CHLORIDE CONTENT - %                ********
    RANGE CHLORIDE CONTENT - %                  ******
    FUEL FIRING RATE - M T/H                    *******        (*** TPH)
    FUEL FIRING RATE - MW                       *****

 ** ESP
    NUMBER                                        1
    SUPPLIER                                    RESEARCH COTTRELL
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %      99.1

 ** FGD SYSTEM
    SALEABLE PRODUCT/THROWAWAY PRODUCT          THROWAWAY PRODUCT
    GENERAL PROCESS TYPE                        WET SCRUBBING
    PROCESS TYPE                                LIME
    PROCESS ADDITIVES                           CARBIDE
    SYSTEM SUPPLIER                             COMBUSTION ENGINEERING
    CONSTRUCTION FIRM                           PIONEER SERVICES
    DEVELOPMENT LEVEL                           FULL-SCALE
    NEW/RETROFIT                                RETROFIT
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %      99.10
    SO2 DESIGN REMOVAL EFFICIENCY - %              90.00
    INITIAL START-UP                             4/73
    CONSTRUCTION COMPLETION                      4/73
    CONSTRUCTION INITIATION                      6/72
    CONTRACT AWARDED                             7/71
    STARTED REQUESTING BIDS                     12/70
    STARTED PRELIMINAY DESIGN                    0/70

 ** ABSORBER
    NUMBER                                       2
    TYPE                                        MARBLE BED
    INITIAL START UP                             4/73
    SUPPLIER                                    COMBUSTION ENGINEERING
    NUMBER OF STAGES                               2
    DIMENSIONS                                  17X18X50 HIGH
    SHELL MATERIAL                              2 1/2 INCH THICK FRP
    SHELL LINER MATERIAL                        316 SS
    GAS FLOW - CU.M/S                              82.58       ( 175000 ACFM)
    GAS TEMPERATURE - C                           176.7        (  350 F)
    L/G RATIO - L/CU.M                              2.2        ( 16.5 GAL/1000ACF)
    PRESSURE DROP - KPA                             2.9        (11.5 IN-H2O)
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    SUPERFICAL GAS VELOCITY - M/SEC             2.7          ( 9.0 FT/S)
    SO2 INLET CONCENTRATION - PPM             2000

** VACUUM FILTER
    NUMBER                                    2
    TYPE                                      ROTARY DRUM
    CONSTRUCTION MATERIAL                     NYLON BELT
    CAPACITY - M T/D                           217.7         (  240 T/D)
    INLET SOLIDS - %                            22.0
    OUTLET SOLIDS - %                           45.0

** MIST ELIMINATOR
    NUMBER                                    2
    TYPE                                      CHEVRON
    CONSTRUCTION MATERIAL                     FIBERGLASS
    FREEBOARD DISTANCE - M                       1.37        ( 4.5 FT)
    DEPTH - M                                    1.52        ( 5.0 FT)
    VANE SPACING - CM                            2.5         ( 1.00 IN)
    VANE ANGLES                               45 DEG.
    WASH SYSTEM                               WATER WASH-RIVER, 60 PSI, 100-200 GPM, DURATION
    PRESSURE DROP - KPA                          .4          ( 1.5 IN-H2O)

** TANKS
    SERVICE                                   NUMBER
    -------                                   ------
    REACTION TANK                             ****
    SCRUBBER RECIRCULATION                    ****
    REACTION SURGE TANK                       ****
    ADDITIVE SLURRY TANK                      ****

** REHEATER
    TYPE                                      DIRECT COMBUSTION
    TEMPERATURE BOOST - C                       21.7         (   39 F)

** THICKENER
    NUMBER                                    1
    DIAMETER - M                                15.2         ( 50 FT)
    OUTLET SOLIDS - %                           22.0

** WATER LOOP
    TYPE                                      CLOSED
    FRESH MAKEUP WATER ADDITION - LITERS/S       3.1         (   50 GPM)

** TREATMENT
    TYPE                                      FIXATION WITH LIME
    SUPPLIER                                  NONPROPRIETARY

** DISPOSAL
    NATURE                                    FINAL
    TYPE                                      UNLINED POND
    TRANSPORTATION                            TRUCK
    AREA - ACRES                                10.0
    CAPACITY - CU.M                               30575      (    25.0 ACRE-FT)


------------------------------------------PERFORMANCE DATA------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------

 4/73   6A                  18.0
        6B                  56.0
        SYSTEM                                                                720

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   4/73     EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     4/73     COMMENTS:
                           MODULES WERE OPERATED ONE AT A TIME, WITH FREQUENT SHUTDOWNS FOR INSPECTIO
                           OF EQUIPMENT AND MINOR REPAIRS.
              AFFECTED MODULES: SYSTEM

 5/73   6A                  11.0
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-------------------------------------------PERFORMANCE DATA-----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL    PER BOILER  FGD   CAP.
                                                                 SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ----- ----- ------
       6B                      65.0
       SYSTEM                                                                 744

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   5/73      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     5/73      COMMENTS:
                           SINGLE-MODULE OPERATION CONTINUED THROUGH MAY 19, WHEN THE UNIT WAS SHUT
                           DOWN FOR MODIFICATIONS.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   5/73      EQUIPMENT: THICKENER
              END DATE     5/73      PROBLEM: NOT DEFINED/SPECIFIED
                           EQUIPMENT WAS INSTALLED FOR INJECTION OF A FLOCCULATING AGENT INTO THE
                           CLARIFIER TANK.
              AFFECTED MODULES: SYSTEM

 6/73  6A                       1.0
       6B                       6.0
       SYSTEM                                                                 720

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   6/73      EQUIPMENT: RECYCLE PUMP
              END DATE     6/73      PROBLEM: MECHANICAL-RELATED COMPONENT INEFFICIENCY
                           OPERATION WAS INTERMITTENT FROM JUNE 19 TO JULY 11 BECAUSE OF MECHANICAL
                           PROBLEMS WITH THE SLURRY PUMPS.
              AFFECTED MODULES: SYSTEM

 7/73  6A                      21.0
       6B                      21.0
       SYSTEM                                                                 744

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   7/73      EQUIPMENT: REAGENT HANDLING
              END DATE     7/73      PROBLEM: CHEMICAL-RELATED PLUGGING
                           DURING A SCHEDULED OUTAGE FROM JULY 12 TROUGH AUGUST 1, SEVERAL REPAIRS
                           WERE MADE TO THE LIME SLURRY MAKE-UP SYSTEM. A DISINTEGRATOR UNIT WAS
                           INSTALLED TO REDUCE PLUGGING OF STRAINERS AND SLURRY CONTROL VALVES.
              AFFECTED MODULES: SYSTEM

 8/73  6A                      53.0
       6B                      64.0
       SYSTEM                                                                 744

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   8/73      EQUIPMENT: BOILER-RELATED
              END DATE     8/73      PROBLEM: NOT DEFINED/SPECIFIED
                           THE OPERATION WAS CONTINUOUS FROM AUGUST 2 TO AUGUST 18 EXCEPT FOR A BRIEF
                           SHUTDOWN DUE TO A BOILER-RELATED PROBLEM.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   8/73      EQUIPMENT: THICKENER
              END DATE     8/73      PROBLEM: NOT DEFINED/SPECIFIED
                           FROM AUGUST 18 TO SEPTEMBER 5, THE SYSTEM WAS SHUT DOWN TO REPLACE THE
                           CLARIFIER'S UNDERFLOW LINE WITH ONE OF LARGER DIAMETER AND TO INSTALL
                           ADDITIONAL PUMP CAPACITY IN THE CLARIFIERS'S OVERFLOW SYSTEM.
              AFFECTED MODULES: SYSTEM

 9/73  6A                      85.0
       6B                      72.0
       SYSTEM                                                                 720

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   9/73      EQUIPMENT: ABSORBER
              END DATE     9/73      PROBLEM: NOT DEFINED/SPECIFIED
                           THE UNIT OPERATED CONTINUOUSLY BETWEEN SEPTEMBER 6 AND 20 EXCEPT FOR A
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---------------------------------------PERFORMANCE DATA---------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL    PER BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                           7-HOUR SHUTDOWN TO REPAIR A MARBLE BED SUPPORT PLATE.
              AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  9/73       EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE    9/73       COMMENTS:
                           THE UNIT WAS SHUT DOWN FROM SEPTEMBER 20 TO THE END OF THE MONTH.
              AFFECTED MODULES: SYSTEM

10/73  6A                      49.0
       6B                      94.0
       SYSTEM                                                               744

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  10/73      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE    12/73      COMMENTS:
                           THE FGD SYSTEM WAS OPERATED UNTIL DECEMBER 20 AFTER WHICH THE BOILER AND
                           THE SCRUBBER MODULES WERE SHUT DOWN BECAUSE OF NO DEMAND (THIS IS A
                           PEAKING-LOAD BOILER).
              AFFECTED MODULES: SYSTEM

11/73  6A                      35.0
       6B                     100.0
       SYSTEM                                                               720

12/73  6A                      44.0
       6B                      78.0
       SYSTEM                                                               744

 1/74  SYSTEM                                                               744

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  1/74       EQUIPMENT: BOILER-RELATED
              END DATE    7/74       COMMENTS:
                           THE BOILER WAS SHUT DOWN BECAUSE OF NO DEMAND.
              AFFECTED MODULES: SYSTEM

 2/74  SYSTEM                                                               672

 3/74  SYSTEM                                                               744

 4/74  SYSTEM                                                               720

 5/74  SYSTEM                                                               744

 6/74  SYSTEM                                                               720

 7/74  SYSTEM                                                               744

 8/74  6A                      50.0
       6B                      77.0
       SYSTEM                                                               744

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  8/74       EQUIPMENT: BOILER-RELATED
              END DATE    8/74       COMMENTS:
                           UNIT HAS BEEN ON AND OFF FREQUENTLY DUE TO FLUCTUATION IN POWER DEMAND.
              AFFECTED MODULES: SYSTEM

 9/74  SYSTEM                                                               720

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  9/74       EQUIPMENT: BOILER-RELATED
              END DATE    9/74       COMMENTS:
                           THE BOILER WAS SHUT DOWN BECAUSE OF NO DEMAND.
              AFFECTED MODULES: SYSTEM
```

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-----------------------------------------------PERFORMANCE DATA-----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

10/74  6A                      100.0
       6B                      100.0
       SYSTEM                                                                  744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/74      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    10/74      COMMENTS: RESEARCH AND DEVELOPMENT
                         BOILER TURNED ON SPECIFICALLY TO PERFORM LIMESTONE TESTS ON FGD SYSTEM.
             AFFECTED MODULES: SYSTEM

11/74  SYSTEM                                                                  720

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  11/74      EQUIPMENT: BOILER-RELATED
             END DATE     8/75      COMMENTS:
                         THE BOILER WAS SHUT DOWN BECAUSE OF NO DEMAND.
             AFFECTED MODULES: SYSTEM

12/74  SYSTEM                                                                  744

 1/75  SYSTEM                                                                  744

 2/75  SYSTEM                                                                  672

 3/75  SYSTEM                                                                  744

 4/75  SYSTEM                                                                  720

 5/75  SYSTEM                                                                  744

 6/75  SYSTEM                                                                  720

 7/75  SYSTEM                                                                  744

 8/75  SYSTEM                                                                  744

 9/75  6A                      100.0
       6B                      100.0
       SYSTEM                                                                  720

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   9/75      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    10/75      COMMENTS:
                         THE BOILER AND FGD SYSTEM WERE OPERATIONAL ALL OF SEPTEMBER AND THE FIRST
                         TWO WEEKS IN OCTOBER. OPERABILITY FOR BOTH MODULES DURING THE OPERATIONAL
                         PERIOD WAS 100 PERCENT (BASED UPON LG&E'S PEAK LOAD DETERMINATION). SO2
                         REMOVAL WAS REPORTED TO BE OVER 96 PERCENT.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   9/75      EQUIPMENT: BOILER-RELATED
             END DATE    10/75      PROBLEM: NOT DEFINED/SPECIFIED
                         SYSTEM OUTAGE IN THE LAST TWO WEEKS OF OCTOBER WAS DUE PRIMARILY TO BREECH
                         ING IN THE BOILER SECTION.
             AFFECTED MODULES: SYSTEM

10/75  6A                      100.0
       6B                      100.0
       SYSTEM                                                                  744

11/75  6A                      100.0
       6B                      100.0
       SYSTEM                                                                  720

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  11/75      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    12/75      COMMENTS:
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SECTION 3

DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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-------------------------------------------PERFORMANCE DATA-------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION    % REMOVAL    PER  BOILER   FGD   CAP.
                                                                  SO2  PART.  HOURS HOURS   HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------   ----- -----  ----- -----   ----- ------
                            THE BOILER AND SCRUBBER SYSTEM RAN MOST OF THE REPORT PERIOD ON MONDAY-
                            FRIDAY BASIS.
              AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   11/75      EQUIPMENT: SCRUBBER
              END DATE     12/75      PROBLEM: NOT DEFINED/SPECIFIED
                            TWO MINOR OUTAGES IN DECEMBER WERE DUE TO MALFUNCTION AND REPAIR OF THE
                            DUAL STRAINER SWITCH SHAFT IN THE BOTTOM OF THE SCRUBBER MODULE.
              AFFECTED MODULES: SYSTEM

12/75   6A                       90.0
        6B                       90.0
        SYSTEM                                                                       744

 1/76   6A                      100.0
        6B                      100.0
        SYSTEM                                                                       744

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    1/76      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE      1/76      COMMENTS:
                            SO2 REMOVAL EFFICIENCY WAS REPORTED TO BE 99 PERCENT DURING JANUARY.
              AFFECTED MODULES: SYSTEM

 2/76   SYSTEM                                                                       696

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    2/76      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE      2/76      COMMENTS:
                                  EXTENSIVE SLUDGE STUDY: FIXATION, LEACHATES, SEASONAL VARIATIONS.
                            SCRUBBER/SLUDGE STUDY SCHEDULED FOR JUNE OR JULY. THE SCRUBBER WILL NOT
                            BE OPERATED UNTIL THE START OF THE STUDY PROGRAM UNLESS THE BOILER IS
                            REQUIRED FOR PEAKING POWER DEMANDS. HIGHLIGHTS OF THE SCRUBBER/SLUDGE
                            STUDY PROGRAM ARE AS FOLLOWS.
                                  6 MONTHS DURATION.
                                  ONE SCHEDULED SHUTDOWN FOR TEST MODIFICATIONS.
                                  DELIBERATE HIGH CHLORIDE CONCENTRATION OPERATION.
                                  MGO INNOCULATION.
              AFFECTED MODULES: SYSTEM

 3/76   SYSTEM                                                                       744

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    3/76      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE      4/76      COMMENTS:
                            THE UNIT DID NOT OPERATE DURING THE REPORT PERIOD IN ANTICIPATION OF THE
                            EPA SCRUBBER/SLUDGE STUDY. THE UTILITY IS NOW COMPLETING SYSTEM MODIFICA-
                            TIONS FOR THE OPERATION OF THE TEST PROGRAM.
              AFFECTED MODULES: SYSTEM

 4/76   SYSTEM                                                                       720

 5/76   6A                      100.0
        6B                      100.0
        SYSTEM                                                                       744

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    5/76      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE      6/76      COMMENTS:
                            THIS PEAK LOAD UNIT WAS OPERATED PART OF THE TIME DURING THE REPORT PERIOD
                            (APPROXIMATELY 2 WEEKS IN MAY AND TWO WEEKS IN JUNE). THE SCRUBBER WAS
                            AVAILABLE TO THE BOILER 100 PERCENT OF THE TIME AND SO2 REMOVAL EFFICIENCY
                            WAS 98 TO 99 % DURING THIS OPERATING SEGMENT.
              AFFECTED MODULES: SYSTEM

 6/76   SYSTEM                                                                       720
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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-------------------------------------------PERFORMANCE DATA--------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------

 7/76  6A                  100.0
       6B                  100.0
       SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   7/76     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     8/76     COMMENTS:
                        THIS UNIT WAS OPERATIONAL PART OF THE TIME DURING THE JULY-AUGUST PERIOD.
                        THE SCRUBBING SYSTEM WAS AVAILABLE TO THE BOILER ON A 100 PERCENT BASIS.
                        NO MAJOR SCRUBBER-RELATED PROBLEMS WERE ENCOUNTERED.
            AFFECTED MODULES: SYSTEM

 8/76  6A                  100.0
       6B                  100.0
       SYSTEM                                                                744

 9/76  SYSTEM                                                                720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/76     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    10/76     COMMENTS: RESEARCH AND DEVELOPMENT
                        THE UNIT DID NOT OPERATE THROUGHOUT SEPTEMBER AND THE FIRST 3 WEEKS IN
                        OCTOBER. THE EPA-FUNDED SCRUBBER/SLUDGE STUDY PROGRAM COMMENCED OCTOBER 25
                        THE INITIAL PHASE OF THE PROGRAM CALLS FOR OPERATIONS TO PROCEED FOR A 20
                        TO 30-DAY PERIOD WITH CARBIDE LIME SCRUBBING ABSORBENT. FOLLOWING COMPLE-
                        TION OF THIS RUN, THE UNIT WILL BE SHUT DOWN AND MODIFICATIONS WILL BE
                        INCORPORATED INTO THE SYSTEM FOR OPERATION WITH COMMERCIAL GRADE (HIGH
                        CALCIUM) LIME.
            AFFECTED MODULES: SYSTEM

10/76  SYSTEM                                                                744

11/76  6A                   99.0
       6B                   99.0
       SYSTEM                                                                720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/76     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    12/76     COMMENTS: RESEARCH AND DEVELOPMENT
                        THE UNIT WAS IN SERVICE DURING THE REPORT PERIOD. THE SCRUBBING SYSTEM
                        OPERATED 99.5 PERCENT OF THE TIME THE BOILER WAS IN SERVICE CARBIDE LIME
                        WAS EMPLOYED AS THE SO2 ABSORBENT. THE HIGH CALCIUM (VIRGIN) LIME RUN,
                        SCHEDULED AS PART OF THE SCRUBBER/SLUDGE STUDY, WILL COMMENCE ON MARCH 1,
                        1977.
            AFFECTED MODULES: SYSTEM

12/76  6A                   99.0
       6B                   99.0
       SYSTEM                                                                744

 1/77  SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/77     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     2/77     COMMENTS:
                        BECAUSE OF SEVERE WEATHER CONDITIONS THERE WERE NO BOILER OPERATIONS AND
                        NO SCRUBBER OPERATIONS UNTIL MARCH 15, 1977.
            AFFECTED MODULES: SYSTEM

 2/77  SYSTEM                                                                672

 3/77  SYSTEM                                                                744

 4/77  SYSTEM                                                                720

 5/77  SYSTEM                                                                744
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------------------------------------------PERFORMANCE DATA-----------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- -----  ----- ------

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   5/77     EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE     5/77     COMMINTS: RESEARCH AND DEVELOPMENT
                        IN MID MARCH LG&E BEGAN TESTS FOR EPA WITH REGULAR LIME SINCE ONE OF THE
                        OBJECTIVES OF THE TEST WAS TO DETERMINE WHETHER THERE WERE APPRECIABLE
                        DIFFERENCES BETWEEN REGULAR LIME AND CARBIDE LIME AT THIS FACILITY. DURING
                        OPERATION WITH REGULAR LIME, SCALING PROBLEMS OCCURRED, INDICATING THAT TH
                        SCALING RESULTED FROM INCREASED OXIDATION LEVELS. AVAILABLE OPTIONS FOR
                        CONTROLLING SCALING WERE LIMITED BY THE FIXED DESIGN FEATURES OF THE SCRUB
                        BER HARDWARE. THE OPTION SELECTED WAS ADDITION OF MGO TO THE SCRUBBING
                        MEDIUM. WHEN MGO WAS ADDED, THE SCALING PROBLEM WAS ELIMINATED, ALLOWING
                        COMPLETION OF THE TEST PROGRAM.
           AFFECTED MODULES: SYSTEM

 6/77  SYSTEM                                                                    720

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   6/77     EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE     8/77     COMMENTS: RESEARCH AND DEVELOPMENT
                       THE SCRUBBER/SLUDGE EVALUATION STUDY CONTINUED DURING THE PERIOD.  THE
                        SCRUBBER PLANT (ONE MODULE IS BEING UTILIZED FOR THIS EXPERIMENTAL PROGRAM
                        WAS IN SERVICE ON A VIRTUALLY CONTINUOUS BASIS FROM JUNE 18 TO AUGUST 8
                        OPERATING ON MAGNESIUM INNOCULATED COMMERCIAL LIME. SYSTEM OPERABILITY
                        DURING THIS PERIOD WAS APPROXIMATELY 96%. SO2 REMOVAL EFFICIENCY WAS
                        MEASURED IN EXCESS OF 99.5%. THE SYSTEM WAS SHUT DOWN AT THIS POINT TO
                        PERFORM A NUMBER OF SCHEDULED MODIFICATIONS TO THE SYSTEM FOR TEST PUR-
                        POSES. SPECIFICALLY, MODIFICATIONS ARE BEING IMPLEMENTED TO THE SYSTEM IN
                        ORDER TO BYPASS THE REACTION TANK IN ORDER TO CONDUCT A SHORT TERM RETEN-
                       TION TIME TEST.  THE TESTING WAS COM_PLETED IN AUGUST '77 AFTER THE MODIFI-
                       CATIONS WERE MADE.
           AFFECTED MODULES: SYSTEM

 7/77  SYSTEM                                                                    744

 8/77  SYSTEM                                                                    744

 9/77  SYSTEM                                                                    720

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   9/77     EQUIPMENT: BOILER-RELATED
           END DATE     3/78     COMMENTS:
                        THE UNIT IS CURRENTLY NOT OPERATING DUE TO THE LACK OF POWER REQUIREMENT.
           AFFECTED MODULES: SYSTEM

10/77  SYSTEM                                                                    744

11/77  SYSTEM                                                                    720

12/77  SYSTEM                                                                    744

 1/78  SYSTEM                                                                    744

 2/78  SYSTEM                                                                    672

 3/78  SYSTEM                                                                    744

 4/78  SYSTEM                                                                    720

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   4/78     EQUIPMENT: BOILER-RELATED
           END DATE     5/78     COMMENTS:
                        PADDY'S RUN WAS ON LINE ONLY A FEW HOURS DURING THIS PERIOD. NO OPERATIONA
                        PROBLEMS WERE REPORTED BY THE UTILITY.
           AFFECTED MODULES: SYSTEM

 5/78  SYSTEM                                                                    744
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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------------------------------------------PERFORMANCE DATA-----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION % REMOVAL   PER BOILER   FGD   CAP.
                                                                SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------

 6/78  SYSTEM                                                                720

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   6/78      EQUIPMENT: BOILER-RELATED
             END DATE     7/78      COMMENTS:
                          THE UNIT RAN INTERMITTENTLY FOR ABOUT EIGHT TO TEN DAYS OVER THIS PERIOD.
             AFFECTED MODULES: SYSTEM

 7/78  SYSTEM                                                                744

 8/78  SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   8/78      EQUIPMENT: THICKENER
             END DATE     9/78      COMMENTS: RESEARCH AND DEVELOPMENT
                          THIS UNIT WAS OPERATED FOR TWO WEEKS IN SEPTEMBER SO THAT TESTING OF A NEW
                          FLOCCULANT COULD BE CARRIED OUT. THE RESULTS OF THESE TESTS WILL DETERMINE
                          THE TYPE OF FLOCCULANT THAT WILL BE USED IN THE FUTURE AT THE OTHER LG&E
                          UNITS.
             AFFECTED MODULES: SYSTEM

 9/78  SYSTEM                                                                720

10/78  SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/78      EQUIPMENT: BOILER-RELATED
             END DATE    11/78      COMMENTS:
                          THE BOILER WAS NOT OPERATED DURING OCTOBER OR NOVEMBER.
             AFFECTED MODULES: SYSTEM

11/78  SYSTEM                                                                720

12/78  SYSTEM                                                                744           0

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  12/78      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     1/79      COMMENTS:
                          THE UNIT WAS NOT OPERATED DURING DECEMBER OR JANUARY.
             AFFECTED MODULES: SYSTEM

 1/79  SYSTEM                                                                744           0
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                                 SECTION 3
          DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
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COMPANY NAME                                     MINNKOTA POWER COOPERATIVE
PLANT NAME                                       MILTON R. YOUNG
UNIT NUMBER                                      2
CITY                                             CENTER
STATE                                            NORTH DAKOTA
REGULATORY CLASSIFICATION                        B
PARTICULATE EMISSION LIMITATION - NG/J           ******          (****** LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                     516.          ( 1.200 LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW                 690.0
GROSS UNIT GENERATING CAPACITY - MW                477.0
NET UNIT GENERATING CAPACITY W/FGD - MW            408.0
NET UNIT GENERATING CAPACITY WO/FGD - MW           417.0
EQUIVALENT SCRUBBED CAPACITY - MW                  405.0

** BOILER DATA
    SUPPLIER                                     BABCOCK AND WILCOX
    TYPE                                         CYCLONE FIRED
    SERVICE LOAD                                 BASE
    COMMERCIAL SERVICE DATE                       0/77
    MAXIMUM BOILER FLUE GAS FLOW - CU.M/S          953.90        (2021400 ACFM)
    FLUE GAS TEMPERATURE - C                       179.4         ( 355 F)
    STACK HEIGHT - M                               168.          ( 550 FT)
    STACK TOP DIAMETER - M                       *******         (***** FT)

** FUEL DATA
    FUEL TYPE                                    COAL
    FUEL GRADE                                   LIGNITE
    AVERAGE HEAT CONTENT - KJ/KG                  15119.         (  6500 BTU/LB)
    RANGE HEAT CONTENT - BTU/LB                                   ******
    AVERAGE ASH CONTENT - %                      ********
    RANGE ASH CONTENT - %                        5-8
    AVERAGE MOISTURE CONTENT - %                    38.00
    RANGE MOISTURE CONTENT - %                   ******
    AVERAGE SULFUR CONTENT - %                        .70
    RANGE SULFUR CONTENT - %                     ******
    AVERAGE CHLORIDE CONTENT - %                 ********
    RANGE CHLORIDE CONTENT - %                   ******
    FUEL FIRING RATE - M T/H                     *******         (*** TPH)
    FUEL FIRING RATE - MW                        *****

** ESP
    NUMBER                                        2
    SUPPLIER                                     WHEELABRATOR-FRYE
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %       99.6

** FGD SYSTEM
    SALEABLE PRODUCT/THROWAWAY PRODUCT           THROWAWAY PRODUCT
    GENERAL PROCESS TYPE                         WET SCRUBBING
    PROCESS TYPE                                 LIME/ALKALINE FLYASH
    SYSTEM SUPPLIER                              ADL/COMBUSTION EQUIP ASSOCIATE
    A-E FIRM                                     SANDERSON & PORTER
    DEVELOPMENT LEVEL                            FULL-SCALE
    NEW/RETROFIT                                 NEW
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %       99.60
    SO2 DESIGN REMOVAL EFFICIENCY - %               75.00
    COMMERCIAL DATE                               6/78
    INITIAL START-UP                              9/77
    CONSTRUCTION INITIATION                       9/75
    CONTRACT AWARDED                              4/75

** ABSORBER
    NUMBER                                        2
    TYPE                                         SPRAY TOWER
    INITIAL START UP                              6/77
    L/G RATIO - L/CU.M                              10.7         ( 80.0 GAL/1000ACF)
    PARTICULATE INLET LOAD - G/CU.M                   .0         (  .005 GR/SCF)
    SO2 INLET CONCENTRATION - PPM                 1900
    SO2 OUTLET CONTRATION - PPM                    475
    SO2 DESIGN REMOVAL EFFICIENCY - %               75.0

** CENTRIFUGE
    NUMBER                                        2

** FANS
    NUMBER                                        2
    TYPE                                         BOILER I.D.
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 ** FANS
     NUMBER                                          1
     TYPE                                            BOILER I.D. (SPARE)

 ** VACUUM FILTER
     NUMBER                                          2
     TYPE                                            ROTARY DRUM
     CAPACITY - M T/D                                  45.3         (    50 T/D)
     OUTLET SOLIDS - %                                 60.0

 ** MIST ELIMINATOR
     TYPE                                            CHEVRON

 ** TANKS
     SERVICE                                         NUMBER
     -------                                         ------
     RECYCLE/REACTION                                  2

 ** REHEATER
     TYPE                                            BYPASS
     TEMPERATURE BOOST - C                             13.9         (    25 F)

 ** THICKENER
     CONSTRUCTION MATERIAL                           CONCRETE WITH POLYETHYLENE COATING
     OUTLET SOLIDS - %                                 40.0

 ** WATER LOOP
     TYPE                                            OPEN
     FRESH MAKEUP WATER ADDITION - LITERS/S            44.1         (   700 GPM)

 ** DISPOSAL
     NATURE                                          FINAL
     TYPE                                            MINEFILL
     LOCATION                                        OFF-SITE
     TRANSPORTATION                                  TRUCK


------------------------------------------PERFORMANCE DATA-------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

  9/77  SYSTEM                                                             720

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    9/77      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE      9/77      COMMENTS:
                                  THE UTILITY REPORTED INTERMITTENT OPERATION SINCE INITIAL START-UP.
              AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    9/77      EQUIPMENT: PIPING
              END DATE      9/77      PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                                  MAJOR OPERATIONAL PROBLEMS HAVE OCCURRED AS A RESULT OF SEVERE WINTER
                                  WEATHER CONDITIONS, PARTICULARLY NUMEROUS INSTANCES OF FROZEN AND RUPTURED
                                  LINES.  THE SYSTEM WAS SHUT DOWN DURING THE FIRST PART OF THE MONTH OF
                                  DECEMBER TO INSTALL HEAT TRACING IN THE LIQUID CIRCUIT.
              AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    9/77      EQUIPMENT: INSTRUMENTATION
              END DATE      9/77      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                                  SOME MINOR PROBLEMS HAVE OCCURRED WITH THE FLOW METERS (ROTAMETERS).
              AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    9/77      EQUIPMENT: GAS DAMPER
              END DATE      9/77      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                                  SOME MINOR PROBLEMS HAVE BEEN REPORTED WITH THE SYSTEM'S GUILLOTINE GAS
                                  DAMPERS.
              AFFECTED MODULES: SYSTEM

 10/77  SYSTEM                                                             744
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-------------------------------------------PERFORMANCE DATA--------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD    CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/77     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    11/77     PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                                  WORK CONTINUED ON INSTALLATION OF ELECTRICAL HEAT TRACING ON SLURRY LINES
                                  AND WATER PIPING.
            AFFECTED MODULES: SYSTEM

11/77  SYSTEM                                                                 720

12/77  SYSTEM                                                                 744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/77     EQUIPMENT: BOILER-RELATED
            END DATE    1/78      COMMENTS:
                                  THERE WAS AN EMERGENCY SHUTDOWN ON DECEMBER 5 AS A RESULT OF BEARING DAM-
                                  AGE WITHIN THE TURBINES.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/77     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    1/78      COMMENTS:
                                  A COMPLIANCE TEST ORIGINALLY SCHEDULED TO BE WITHIN THIS PERIOD HAS BEEN
                                  TENTATIVELY RESCHEDULED WITH THE EPA FOR THE END OF MARCH. THE UNIT IS
                                  TO HAVE THE SYSTEMS IN EQUILIBRIUM (WATER BALANCE).
            AFFECTED MODULES: SYSTEM

0/78   A           92.3        28.0                     22.2
       B           28.5        25.9                     20.4
       SYSTEM      46.0        53.0        54.0         42.0                  876   692           66.7

1/78   SYSTEM                                                                 744

2/78   SYSTEM                                                                 672

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  2/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    3/78      COMMENTS:
                                  BOTH THE BOILER AND FGD SYSTEM CAME BACK ON LINE FEBRUARY 21 AFTER COM-
                                  PLETION OF THE TURBINE REPAIRS. THE COMPLIANCE TEST HAS AGAIN BEEN RE-
                                  SCHEDULED WITH EPA FOR THE END OF MAY.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  2/78      EQUIPMENT: FAN
            END DATE    3/78      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                                  ONE FORCED-DRAFT FAN (UPSTREAM OF THE FGD SYSTEM) HAD AN OIL LEAK AND A
                                  SHAFT ALIGNMENT PROBLEM.  THE FAN WAS TAKEN OFF LINE AND SHIPPED TO
                                  BUFFALO FORGE FOR REPAIRS.  THE AFFECTED MODULE WAS DOWN FROM FEBRUARY 23
                                  THROUGH APRIL 10, WHEN THE REPAIRED UNIT WAS RE-INSTALLED.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  2/78      EQUIPMENT: VACUUM FILTER
            END DATE    3/78      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                                  THE VACUUM FILTER MALFUNCTIONED, ALLOWING LARGER SIZE PARTICLES TO ESCAPE
                                  THE FILTER.  THIS CAUSED THE RUBBER LINING DOWN STREAM TO PEEL WHICH, IN
                                  TURN, CREATED A PLUGGING PROBLEM.  EIMCO ENGINEERS ARE PRESENTLY STUDYING
                                  THE PROBLEM AND HOPE TO INCORPORATE MODIFICATIONS TO IMPROVE THE PERFOR-
                                  MANCE OF THE FILTERS.
            AFFECTED MODULES: SYSTEM

3/78   SYSTEM                                                                 744

4/78   SYSTEM                                                                 720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  4/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    7/78      COMMENTS:
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------------------------------------------PERFORMANCE DATA----------------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ----- ----- ------
                     COMPLIANCE TESTING TOOK PLACE DURING THE WEEK OF JUNE 5.  THE REPORT
                     SHOULD BE AVAILABLE TO THE UTILITY BY THE END OF JUNE.
              AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   4/78      EQUIPMENT: GAS DAMPER
              END DATE     7/78      PROBLEM: DESIGN-RELATED UNDERSIZED COMPONENT
                                     THE UNIT WAS DOWN WITH DAMPER PROBLEMS (DOWN ON THE 24TH OF JUNE).  AP-
                                     PARENTLY THE CHAINS THAT PULL THE GUILLOTINE DAMPERS WERE UNDERDESIGNED
                                     AND HAVE BEEN REPLACED.
              AFFECTED MODULES: SYSTEM

 5/78   SYSTEM                                                                 744

 6/78   SYSTEM                                                                 720

 7/78   SYSTEM                                                                 744

 8/78   SYSTEM                                                                 744

          ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   8/78      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     9/78      COMMENTS:
                                     OFFICIAL RESULTS OF THE COMPLIANCE TEST PERFORMED ON JUNE 6 ARE STILL NOT
                                     AVAILABLE.  BECAUSE OF INTERMITTENT OPERATION, HOURS ARE NOT YET AVAILABLE
              AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   8/78      EQUIPMENT: THICKENER
              END DATE     9/78      PROBLEM: MECHANICAL-RELATED MATERIALS FAILURE
                                     THE THICKENER HAS BEEN A MAJOR PROBLEM AREA.  THE POLYETHYLENE LINER WAS
                                     ACCIDENTLY PIERCED DURING REPAIRS AND HAD TO BE PATCHED.
              AFFECTED MODULES: SYSTEM

 9/78   SYSTEM                                                                 720

10/78   SYSTEM                                                                 744

          ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   10/78     EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     12/78     COMMENTS:
                                     THE UTILITY HAS REPORTED OPERATIONAL PARAMETERS FOR THE ENTIRE YEAR OF
                                     1978.  NO INDIVIDUAL MONTHLY FIGURES WERE AVAILABLE.
              AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   10/78     EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     11/78     COMMENTS:
                                     THE UTILITY REPORTED THAT OPERATION OF THE BOILER AND FGD SYSTEM CONTINUED
                                     ON AN INTERMITTENT BASIS THROUGHOUT THE PERIOD.
              AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   10/78     EQUIPMENT: THICKENER
              END DATE     11/78     PROBLEM: MECHANICAL-RELATED MATERIALS FAILURE
                                     THICKENER LINING PROBLEMS WERE ENCOUNTERED.
              AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   10/78     EQUIPMENT: ABSORBER
              END DATE     11/78     PROBLEM: CHEMICAL-RELATED EROSION
                                     EROSION IN THE SPRAY TOWERS WAS SEVERE ENOUGH TO CAUSE HOLES IN THE TOWERS
              AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   10/78     EQUIPMENT: FAN
              END DATE     11/78     PROBLEM: NOT DEFINED/SPECIFIED
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-------------------------------------------PERFORMANCE DATA---------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                               SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                  F.D. FAN PROBLEMS HAVE CONTINUED AND HAVE BEEN A MAJOR CONCERN.
          AFFECTED MODULES: SYSTEM

11/78  SYSTEM                                                                720

12/78  SYSTEM                                                                744

 1/79  SYSTEM                                                                744

      ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE    1/79      EQUIPMENT: FAN
          END DATE      1/79      PROBLEM: COMPONENT FAILURE, OTHER
                        DUE TO A FAILURE OF A FORCED DRAFT FAN MOTOR 3 MODULE WAS DOWN AND UNIT
                        WAS AT HALF LOAD.
          AFFECTED MODULES: B

      ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE    1/79      EQUIPMENT: ABSORBER
          END DATE      1/79      COMMENTS:
                        WHILE THE FAN MOTOR WAS BEING REPAIRED THE HOLES IN THE B TOWER WERE
                        REPAIRED.
          AFFECTED MODULES: B

      ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE    1/79      EQUIPMENT: ABSORBER
          END DATE      1/79      PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                        FREEZING WEATHER PRESENTED START UP DIFICULTY.
          AFFECTED MODULES: A

      ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE    1/79      EQUIPMENT: THICKENER
          END DATE      1/79      PROBLEM: PLUGGING, OTHER
                       THE THICKENER UNDERFLOW BECAME PLUGGED BY THICKENER CONE LINING WHICH
                        RESULTED IN OUTAGE TIME.
          AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE    1/79      EQUIPMENT: GAS DAMPER
          END DATE      1/79      PROBLEM: COMPONENT FAILURE, OTHER
                       A BROKEN INLET ISOLATION DAMPER CAUSED FORCED OUTAGE TIME.
          AFFECTED MODULES: A

      ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE    1/79      EQUIPMENT: FAN
          END DATE      1/79      PROBLEM: NOT DEFINED/SPECIFIED
                        REPAIRS TO A BOOSTER FAN SERVO MECHANISM WERE REQUIRED.
          AFFECTED MODULES: A
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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COMPANY NAME                                     MONTANA POWER
PLANT NAME                                       COLSTRIP
UNIT NUMBER                                      1
CITY                                             COLSTRIP
STATE                                            MONTANA
REGULATORY CLASSIFICATION                        A
PARTICULATE EMISSION LIMITATION - NG/J           ******        (****** LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                     516.        ( 1.200 LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW               *******
GROSS UNIT GENERATING CAPACITY - MW                360.0
NET UNIT GENERATING CAPACITY W/FGD - MW            330.0
NET UNIT GENERATING CAPACITY WO/FGD - MW           342.0
EQUIVALENT SCRUBBED CAPACITY - MW                  360.0

** BOILER DATA
    SUPPLIER                                     ******
    TYPE                                         ******
    SERVICE LOAD                                 BASE
    COMMERCIAL SERVICE DATE                      **/**
    MAXIMUM BOILER FLUE GAS FLOW - CU.M/S        ********      (******* ACFM)
    FLUE GAS TEMPERATURE - C                     *******       (**** F)
    STACK HEIGHT - M                               152.        ( 500 FT)
    STACK TOP DIAMETER - M                       *******       (***** FT)

** FUEL DATA
    FUEL TYPE                                    COAL
    FUEL GRADE                                   SUBBITUMINOUS
    AVERAGE HEAT CONTENT - KJ/KG                  20569.       (  8843 BTU/LB)
    RANGE HEAT CONTENT - BTU/LB                                 8.162 MIN
    AVERAGE ASH CONTENT - %                          8.60
    RANGE ASH CONTENT - %                        6.1-12.6
    AVERAGE MOISTURE CONTENT - %                    23.90
    RANGE MOISTURE CONTENT - %                   ******
    AVERAGE SULFUR CONTENT - %                        .77
    RANGE SULFUR CONTENT - %                     0.4-1.0
    AVERAGE CHLORIDE CONTENT - %                 ********
    RANGE CHLORIDE CONTENT - %                   ******
    FUEL FIRING RATE - M T/H                     *******       (*** TPH)
    FUEL FIRING RATE - MW                        *****

** PARTICULATE SCRUBBER
    NUMBER                                        3
    TYPE                                         VARIABLE THROAT VENTURI
    SUPPLIER                                     COMBUSTION EQUIPMENT ASSOCIATES
    SHELL MATERIAL                               CARBON STEEL
    LINING MATERIAL                              ABRASION RESISTANT BRICKS IN THROAT
    INTERNAL MATERIAL                            316 SS OR AREAS OF PLUMB BOB
    BOILER LOAD/SCRUBBER - %                        33.3
    FLUE GAS TEMPERATURE - C                        48.9       (  120 F)
    L/G RATIO - LITER/CU.M                           2.0       (15.0 GAL/1000ACF)
    PRESSURE DROP - KPA                              4.2       (    17 IN-H2O)
    SO2 INLET CONCENTRATION - PPM                  800.000

** FGD SYSTEM
    SALEABLE PRODUCT/THROWAWAY PRODUCT           THROWAWAY PRODUCT
    GENERAL PROCESS TYPE                         WET SCRUBBING
    PROCESS TYPE                                 LIME
    PROCESS ADDITIVES                            ALKALINE FLYASH
    SYSTEM SUPPLIER                              ADL/COMBUSTION EQUIP ASSOCIATE
    A-E FIRM                                     BECHTEL
    DEVELOPMENT LEVEL                            FULL-SCALE
    NEW/RETROFIT                                 NEW
    COMMERCIAL DATE                              11/75
    INITIAL START-UP                              9/75

** ABSORBER
    NUMBER                                        3
    TYPE                                         SPRAY TOWER
    INITIAL START UP                              9/75
    SUPPLIER                                     COMBUSTION EQUIPMENT ASSOC.
    NUMBER OF STAGES                                1
    SHELL MATERIAL                               CARBON STEEL
    SHELL LINER MATERIAL                         GLASS FLAKE POLYESTER
    L/G RATIO - L/CU.M                               2.4       ( 18.0 GAL/1000ACF)
    SUPERFICAL GAS VELOCITY - M/SEC                  2.7       (  9.0 FT/S)
    PARTICULATE REMOVAL EFFICIENCY - %              99.5
```

SO2 INLET CONCENTRATION -NG/J		(***** LB/MMBTU)
SO2 INLET CONCENTRATION -NG/J		(260 LB/MMBTU)

**** FANS**

NUMBER	3
TYPE	FGD I.D.
CONSTRUCTION MATERIALS	CARBON STEEL, RUBBER LINED CASING

**** MIST ELIMINATOR**

TYPE	CHEVRON	
CONSTRUCTION MATERIAL	NOREL PLASTIC	
CONFIGURATION	HORIZONTAL	
NUMBER OF PASSES	4	
WASH SYSTEM	INTERMITTANT WASH BOTH TOP AND BOTTOM OF MIST EL	
SUPERFICIAL GAS VELOCITY - M/S	2.7	(8.7 FT/S)

**** PROCESS CONTROL CHEMISTRY**

CONTROL VARIABLES	SO2, PH, PERCENT SOLIDS

**** PUMPS**

SERVICE	NUMBER
ABSORBER/VENTURI	2
ABSORBER/VENTURI (SPARE)	1
WASH TRAY	2
WASH TRAY (SPARE)	1
RECYCLE TANK TO THICKENER	****
SLUDGE TO POND	****
POND WATER RETURN	****

**** TANKS**

SERVICE	NUMBER
VENTURI/ABSORBER RECYCLE TANK	3
CLEAR WATER TRAY RECYCLE TANK	1

**** REHEATER**

TYPE	IN-LINE	
HEATING MEDIUM	STEAM	
TEMPERATURE BOOST - C	37.8	(68 F)

**** THICKENER**

NUMBER	1

**** WATER LOOP**

TYPE	CLOSED

**** DISPOSAL**

NATURE	INTERIM
TYPE	LINED POND
LOCATION	ON-SITE

**** DISPOSAL**

NATURE	FINAL
LOCATION	OFF-SITE
TRANSPORTATION	PIPE

PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	FELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
9/75	SYSTEM							720	720		1.0
10/75	SYSTEM							744	456		19.0
11/75	SYSTEM							720	576		42.0
12/75	SYSTEM							744	720		60.0
1/76	SYSTEM	90.0						744	672		64.0
2/76	SYSTEM	98.0						696	624		65.0

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
3/76	SYSTEM	98.0						744	576		57.0
4/76	SYSTEM	74.0						720	672		50.0
5/76	SYSTEM	97.0						744	336		26.0
6/76	SYSTEM							720			
7/76	SYSTEM	93.0						744	480		28.0
8/76	SYSTEM	95.0						744	552		38.0
9/76	SYSTEM	89.0						720	720		65.0
10/76	SYSTEM	80.0						744	720		73.0

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 10/76 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 10/76 COMMENTS:
A TEMPERATURE EXCURSION RESULTED IN DAMAGE TO SYSTEM COMPONENTS CAUSING SYSTEM DOWNTIME.
AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 10/76 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 10/76 PROBLEM: NOT DEFINED/SPECIFIED
THE EMERGENCY SCRUBBER QUENCH WATER SUPPLY SYSTEM FAILED TO OPERATE DURING A TEMPERATURE EXCURSION.
AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 10/76 EQUIPMENT: ABSORBER
END DATE 12/76 PROBLEM: NOT DEFINED/SPECIFIED
THE LININGS WERE DAMAGED DURING A TEMPERATURE EXCURSION.
AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 10/76 EQUIPMENT: MIST ELIMINATOR
END DATE 12/76 PROBLEM: NOT DEFINED/SPECIFIED
MIST ELIMINATOR DAMAGE OCCURED AS THE RESULT OF A TEMPERATURE EXCURSION IN OCTOBER.
AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
11/76	SYSTEM	63.0						720	720		56.0

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 11/76 EQUIPMENT: FAN
END DATE 12/76 PROBLEM: NOT DEFINED/SPECIFIED
A FAILURE OF AN ID FAN MOTOR OCCURED.
AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
12/76	SYSTEM	74.0						744	744		67.0
1/77	SYSTEM	93.0						744	744		73.0
2/77	SYSTEM	95.0						672	480		3.0
3/77	SYSTEM							744			
4/77	SYSTEM	83.0						720	600		50.0
5/77	SYSTEM	85.0						744	624		64.0
6/77	SYSTEM	87.0						720	672		69.0
7/77	SYSTEM	85.0						744	696		72.0

PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
8/77	SYSTEM	93.0						744			
9/77	SYSTEM	93.0						720			
10/77	SYSTEM	96.0						744			
11/77	SYSTEM	96.0						720			
12/77	SYSTEM	98.0						744			
1/78	SYSTEM	96.0						744			
2/78	SYSTEM	100.0						672			
3/78	SYSTEM	92.0						744			
4/78	SYSTEM	100.0						720			
5/78	SYSTEM	66.0						744			

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 5/78 EQUIPMENT: BOILER-RELATED
END DATE 5/78 COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
THE UNIT WAS RESTARTED AFTER ITS ANNUAL OVERHAUL DURING MAY.
AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 5/78 EQUIPMENT: FAN
END DATE 5/78 COMMENTS:
THE I.D. FAN MOTOR WAS NOT AVAILABLE DURING UNIT RESTART.
AFFECTED MODULES: 1A

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
6/78	SYSTEM	76.0						720			
7/78	SYSTEM	96.0						744			
8/78	SYSTEM	97.0						744			
9/78	SYSTEM	96.0						720			
10/78	SYSTEM	95.0						744			
11/78	SYSTEM	91.0						720			

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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COMPANY NAME                                   MONTANA POWER
PLANT NAME                                     COLSTRIP
UNIT NUMBER                                    2
CITY                                           COLSTRIP
STATE                                          MONTANA
REGULATORY CLASSIFICATION                      A
PARTICULATE EMISSION LIMITATION - NG/J         ******        (****** LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                   516.        ( 1.200 LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW             *******
GROSS UNIT GENERATING CAPACITY - MW              360.0
NET UNIT GENERATING CAPACITY W/FGD - MW          330.0
NET UNIT GENERATING CAPACITY WO/FGD - MW         342.0
EQUIVALENT SCRUBBED CAPACITY - MW                360.0

** BOILER DATA
     SUPPLIER                                  ******
     TYPE                                      ******
     SERVICE LOAD                              BASE
     COMMERCIAL SERVICE DATE                   **/**
     MAXIMUM BOILER FLUE GAS FLOW - CU.M/S     ********      (******* ACFM)
     FLUE GAS TEMPERATURE - C                  *******       (**** F)
     STACK HEIGHT - M                            152.        ( 500 FT)
     STACK TOP DIAMETER - M                    *******       (***** FT)

** FUEL DATA
     FUEL TYPE                                 COAL
     FUEL GRADE                                SUBBITUMINOUS
     AVERAGE HEAT CONTENT - KJ/KG               20569.       (  8843 BTU/LB)
     RANGE HEAT CONTENT - BTU/LB                              8,162 MIN
     AVERAGE ASH CONTENT - %                       8.60
     RANGE ASH CONTENT - %                     6.1-12.6
     AVERAGE MOISTURE CONTENT - %                 23.90
     RANGE MOISTURE CONTENT - %                ******
     AVERAGE SULFUR CONTENT - %                     .77
     RANGE SULFUR CONTENT - %                  0.4-1.0
     AVERAGE CHLORIDE CONTENT - %              ********
     RANGE CHLORIDE CONTENT - %                ******
     FUEL FIRING RATE - M T/H                  *******       (*** TPH)
     FUEL FIRING RATE - MW                     *****

** PARTICULATE SCRUBBER
     NUMBER                                     3
     TYPE                                      VARIABLE THROAT VENTURI
     SUPPLIER                                  COMBUSTION EQUIPMENT ASSOCIATES
     SHELL MATERIAL                            CARBON STEEL RESISTANT
     LINING MATERIAL                           ABRASION RESISTANT BRICKS IN THROAT
     INTERNAL MATERIAL                         316 SS ON AREAS OF PLUMB BOB
     BOILER LOAD/SCRUBBER - %                     33.3
     FLUE GAS TEMPERATURE - C                     48.9       (  120 F)
     L/G RATIO - LITER/CU.M                        2.0       (15.0 GAL/1000ACF)
     PRESSURE DROP - KPA                           4.2       (   17 IN-H2O)
     SO2 INLET CONCENTRATION - PPM               800,000

** FGD SYSTEM
     SALEABLE PRODUCT/THROWAWAY PRODUCT        THROWAWAY PRODUCT
     GENERAL PROCESS TYPE                      WET SCRUBBING
     PROCESS TYPE                              LIME
     PROCESS ADDITIVES                         ALKALINE FLYASH
     SYSTEM SUPPLIER                           ADL/COMBUSTION EQUIP ASSOCIATE
     A-E FIRM                                  BECHTEL POWER CORPORATION
     DEVELOPMENT LEVEL                         FULL-SCALE
     NEW/RETROFIT                              NEW
     COMMERCIAL DATE                           10/76
     INITIAL START-UP                           5/76

** ABSORBER
     NUMBER                                     3
     TYPE                                      SPRAY TOWER
     INITIAL START UP                           5/76
     SUPPLIER                                  COMBUSTION EQUIPMENT ASSOC.
     NUMBER OF STAGES                              1
     SHELL MATERIAL                            CARBON STEEL
     SHELL LINER MATERIAL                      POLYESTER FLAKEGLASS
     L/G RATIO - L/CU.M                            2.4       ( 18.0 GAL/1000ACF)
     SUPERFICAL GAS VELOCITY - M/SEC               2.7       (  9.0 FT/S)
     PARTICULATE REMOVAL EFFICIENCY - %           99.5
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    SO2 INLET CONCENTRATION -NG/J                                       (***** LB/MMBTU)
    SO2 INLET CONCENTRATION -NG/J                                       (  260 LB/MMBTU)

 ** FANS
    NUMBER                                       3
    TYPE                                        FGD I.D.
    CONSTRUCTION MATERIALS                      CARBON STEEL, RUBBER LINED CASING

 ** MIST ELIMINATOR
    TYPE                                        CHEVRON
    CONSTRUCTION MATERIAL                       NOREL PLASTIC
    CONFIGURATION                               HORIZONTAL
    NUMBER OF PASSES                               4
    WASH SYSTEM                                 INTERMITTANT WASH BOTH TOP AND BOTTOM OF MIST EL
    SUPERFICIAL GAS VELOCITY - M/S                 2.7          (  8.7 FT/S)

 ** PROCESS CONTROL CHEMISTRY
    CONTROL VARIABLES                           SO2, PH, PERCENT SOLIDS

 ** PUMPS
    SERVICE                                     NUMBER
    -------                                     ------
    ABSORBER/VENTURI                              2
    ABSORBER/VENTURI (SPARE)                      1
    WASH TRAY                                     2
    WASH TRAY (SPARE)                             1
    RECYCLE TANK TO THICKENER                   ****
    SLUDGE TO POND                              ****
    POND WATER RETURN                           ****

 ** TANKS
    SERVICE                                     NUMBER
    -------                                     ------
    VENTURI/ABSORBER RECYCLE TANK                 3
    CLEAR WATER TRAY RECYCLE TANK                 1

 ** REHEATER
    TYPE                                        IN-LINE
    HEATING MEDIUM                              STEAM
    TEMPERATURE BOOST - C                          37.8         (   68 F)

 ** THICKENER
    NUMBER                                       1

 ** WATER LOOP
    TYPE                                        CLOSED

 ** DISPOSAL
    NATURE                                      INTERIM
    TYPE                                        LINED POND
    LOCATION                                    ON-SITE

 ** DISPOSAL
    NATURE                                      FINAL
    TYPE                                        POND
    LOCATION                                    OFF-SITE
    TRANSPORTATION                              PIPE


-----------------------------------------------PERFORMANCE DATA-------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ---- ----- ----- ------ ----- ------

 5/76  SYSTEM     100.0
                                                                            744   336           1.0
 6/76  SYSTEM     100.0
                                                                            720   384          23.0
 7/76  SYSTEM      99.0
                                                                            744   312          20.0
 8/76  SYSTEM      96.0
                                                                            744   240          13.0
 9/76  SYSTEM      98.0
                                                                            720   720          65.0
10/76  SYSTEM      90.0
                                                                            744   744          77.0
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL		PER	BOILER	FGD	CAP.
						SO2	PART.	HOURS	HOURS	HOURS	FACTOR
11/76	SYSTEM	94.0						720	720		80.0
12/76	SYSTEM	93.0						744	744		82.0
1/77	SYSTEM	83.0						744	720		68.0
2/77	SYSTEM	94.0						672	648		75.0
3/77	SYSTEM	97.0						744	672		71.0
4/77	SYSTEM	85.0						720	696		68.0
5/77	SYSTEM	63.0						744	312		23.0
6/77	SYSTEM	88.0						720	672		61.0
7/77	SYSTEM	91.0						744	672		58.0
8/77	SYSTEM	81.0						744			
9/77	SYSTEM	90.0						720			
10/77	SYSTEM	98.0						744			
11/77	SYSTEM	98.0						720			
12/77	SYSTEM	98.0						744			
1/78	SYSTEM	97.0						744			
2/78	SYSTEM	95.0						672			
3/78	SYSTEM	89.0						744			

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 3/78 EQUIPMENT: BOILER-RELATED
END DATE 4/78 COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
THE BOILER WAS SHUT DOWN FOR ANNUAL OVERHAUL.
AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
4/78	SYSTEM	87.0						720			
5/78	SYSTEM	99.0						744			
6/78	SYSTEM	97.0						720			
7/78	SYSTEM	96.0						744			
8/78	SYSTEM	99.0						744		0	
9/78	SYSTEM	94.0						720		0	
10/78	SYSTEM	99.0						744		0	
11/78	SYSTEM	99.0						720		0	

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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COMPANY NAME                                    NEVADA POWER
PLANT NAME                                      REID GARDNER
UNIT NUMBER                                     1
CITY                                            MOAPA
STATE                                           NEVADA
REGULATORY CLASSIFICATION                       A
PARTICULATE EMISSION LIMITATION - NG/J            43.          (  .100 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                   516.          ( 1.200 LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW              *******
GROSS UNIT GENERATING CAPACITY - MW               125.0
NET UNIT GENERATING CAPACITY W/FGD - MW           110.0
NET UNIT GENERATING CAPACITY WO/FGD - MW        *******
EQUIVALENT SCRUBBED CAPACITY - MW                 125.0

** BOILER DATA
    SUPPLIER                                    FOSTER-WHEELER
    TYPE                                        WET BOTTOM
    SERVICE LOAD                                BASE
    COMMERCIAL SERVICE DATE                      0/65
    MAXIMUM BOILER FLUE GAS FLOW - CU.M/S        223.21        ( 473000 ACFM)
    FLUE GAS TEMPERATURE - C                     176.7         ( 350 F)
    STACK HEIGHT - M                              61.          ( 200 FT)
    STACK TOP DIAMETER - M                      *******        (***** FT)

** FUEL DATA
    FUEL TYPE                                   COAL
    FUEL GRADE                                  ******
    AVERAGE HEAT CONTENT - KJ/KG                 28959.        ( 12450 BTU/LB)
    RANGE HEAT CONTENT - BTU/LB                                  ******
    AVERAGE ASH CONTENT - %                           8.00
    RANGE ASH CONTENT - %                       ******
    AVERAGE MOISTURE CONTENT - %                ********
    RANGE MOISTURE CONTENT - %                  ******
    AVERAGE SULFUR CONTENT - %                         .50
    RANGE SULFUR CONTENT - %                    0.5-1.0
    AVERAGE CHLORIDE CONTENT - %                ********
    RANGE CHLORIDE CONTENT - %                  ******
    FUEL FIRING RATE - M T/H                    *******        (*** TPH)
    FUEL FIRING RATE - MW                       *****

** MECHANICAL COLLECTOR
    TYPE                                        MULTICLONES
    SUPPLIER                                    RESEARCH COTTRELL

** PARTICULATE SCRUBBER
    NUMBER                                        2
    TYPE                                        VARIABLE THROAT VENTURI
    SUPPLIER                                    COMBUSTION ENGINEERING
    SHELL MATERIAL                              INCOLOY 825
    TYPE OF NOZZLES                             TANGENTIAL
    BOILER LOAD/SCRUBBER - %                      50.0
    LIQUID RECIRCULATION RATE - LITER/S          157.5         ( 2500 GPM)
    L/G RATIO - LITER/CU.M                         1.3         (10.0 GAL/1000ACF)
    PRESSURE DROP - KPA                            3.7         (   15 IN-H2O)
    SUPERFICIAL GAS VELOCITY - M/S                50.3         (  165.0 FT/S)
    PARTICULATE INLET LOAD - G/CU.M                1.4         (   .60 GR/SCF)
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %     97.0
    SO2 INLET CONCENTRATION - PPM                375.000

** FGD SYSTEM
    SALEABLE PRODUCT/THROWAWAY PRODUCT          THROWAWAY PRODUCT
    GENERAL PROCESS TYPE                        WET SCRUBBING
    PROCESS TYPE                                SODIUM CARBONATE
    SYSTEM SUPPLIER                             ADL/COMBUSTION EQUIP ASSOCIATE
    A-E FIRM                                    BECHTEL
    DEVELOPMENT LEVEL                           FULL-SCALE
    NEW/RETROFIT                                RETROFIT
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %     97.00
    SO2 DESIGN REMOVAL EFFICIENCY - %             90.00
    INITIAL START-UP                             4/74
    CONSTRUCTION INITIATION                     12/72
    CONTRACT AWARDED                             7/71

** ABSORBER
    NUMBER                                        1
    TYPE                                        PERFORATED PLATE WASHING TOWER
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                                        SECTION 3
                     DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
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      INITIAL START UP                              4/74
      NUMBER OF STAGES                                1
      DIMENSIONS                                   30 DIA.
      BOILER LOAD/ABSORBER - %                      100.0
      LIQUID RECIRCULATION RATE - LITER/S            38.          (  600 GPM)
      PRESSURE DROP - KPA                              .7         ( 3.0 IN-H2O)
      SUPERFICAL GAS VELOCITY - M/SEC                 3.4         ( 11.0 FT/S)
      SO2 OUTLET CONTRATION - PPM                    17

   ** FANS
      NUMBER                                        1
      TYPE                                         I.D. BOOSTER FAN
      CONSTRUCTION MATERIALS                       CARBON STEEL

   ** MIST ELIMINATOR
      NUMBER                                        1
      TYPE                                         RADIAL VANE
      CONSTRUCTION MATERIAL                        316L SS
      CONFIGURATION                                HORIZONTAL
      WASH SYSTEM                                  NONE
      PRESSURE DROP - KPA                              .1         (  .5 IN-H2O)

   ** TANKS
      SERVICE                                      NUMBER
      -------                                      ------
      VENTURI RECYCLE                              ****

   ** REHEATER
      TYPE                                         INDIRECT HOT AIR
      HEATING MEDIUM                               STEAM
      TEMPERATURE BOOST - C                          16.7         (   30 F)
      ENERGY REQUIRED                              15.2MM BTU/HR; 4MW

   ** WATER LOOP
      TYPE                                         OPEN
      FRESH MAKEUP WATER ADDITION - LITERS/S          1.6         (   25 GPM)

   ** DISPOSAL
      NATURE                                       INTERIM
      TYPE                                         CLAY LINED POND
      LOCATION                                     ON-SITE
      AREA - ACRES                                    6.0

   ** DISPOSAL
      NATURE                                       FINAL
      TYPE                                         EVAP POND
      LOCATION                                     ON SITE
      TRANSPORTATION                               GRAVITY FLOW FROM INTERIM SLUDGE POND
      AREA - ACRES                                   45.0

------------------------------------------PERFORMANCE DATA-------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                               SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

 4/74  SYSTEM                                                               720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   4/74     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     4/74     COMMENTS:
                       THE SYSTEM WAS FIRST PLACED IN SERVICE IN APRIL 1974.  THE SCRUBBING SYSTE
                       DESIGN WAS BASED ON INFORMATION AND DATA OBTAINED FROM AN 8000-ACFM PILOT
                       PLANT PROGRAM CONDUCTED AT REID GARDNER STATION IN 1971 AND 1972.
            AFFECTED MODULES: SYSTEM

 1/75  SYSTEM                                                               744

 2/75  SYSTEM                                                               672

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   2/75     EQUIPMENT:
            END DATE     2/75     PROBLEM: WEATHER-RELATED COMPONENT FAILURE
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                              SECTION 3
               DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
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--------------------------------------------PERFORMANCE DATA------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                               SO2  PART.  HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                     FROZEN SODIUM CARBONATE FEED LINES ACCOUNTED FOR OUTAGE TIME.
        AFFECTED MODULES: SYSTEM

     ** PROBLEMS/SOLUTIONS/COMMENTS
        START DATE   2/75     EQUIPMENT: FGD SYSTEM, GENERAL
        END DATE     2/75     PROBLEM: NOT DEFINED/SPECIFIED
                     A 2-DAY LACK OF CHEMICALS RESULTED IN OUTAGE TIME.
        AFFECTED MODULES: SYSTEM

 3/75   SYSTEM                                                                 744

 4/75   SYSTEM                                                                 720

     ** PROBLEMS/SOLUTIONS/COMMENTS
        START DATE   4/75     EQUIPMENT: BOILER-RELATED
        END DATE     5/75     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                     THE BOILER WAS SHUT DOWN APRIL 13 FOR ROUTINE MAINTENANCE AND PLACED BACK
                     ON LINE MAY 12.
        AFFECTED MODULES: SYSTEM

 5/75   SYSTEM                                                                 744

     ** PROBLEMS/SOLUTIONS/COMMENTS
        START DATE   5/75     EQUIPMENT: FGD SYSTEM, GENERAL
        END DATE     6/75     COMMENTS:
                     A HIGH ASH CONTENT OF UP TO 20 PERCENT BY WEIGHT OF THE COAL BURNED
                     RECENTLY HAD NO EFFECT ON EMMISSIONS.
        AFFECTED MODULES: SYSTEM

 6/75   SYSTEM                                                                 720

     ** PROBLEMS/SOLUTIONS/COMMENTS
        START DATE   6/75     EQUIPMENT: FGD SYSTEM, GENERAL
        END DATE     6/75     PROBLEM: NOT DEFINED/SPECIFIED
                     ROUTINE MECHANICAL PROBLEMS WERE REPORTED.
        AFFECTED MODULES: SYSTEM

     ** PROBLEMS/SOLUTIONS/COMMENTS
        START DATE   6/75     EQUIPMENT: INSTRUMENTATION
        END DATE     6/75     PROBLEM: NOT DEFINED/SPECIFIED
                     ROUTINE INSTRUMENTAL PROBLEMS WERE REPORTED.
        AFFECTED MODULES: SYSTEM

     ** PROBLEMS/SOLUTIONS/COMMENTS
        START DATE   6/75     EQUIPMENT: PIPING
        END DATE     6/75     PROBLEM: CHEMICAL-RELATED EROSION
                     ABRASION OF RUBBER LINED PIPES WAS A PROBLEM.
        AFFECTED MODULES: SYSTEM

     ** PROBLEMS/SOLUTIONS/COMMENTS
        START DATE   6/75     EQUIPMENT: FGD SYSTEM, GENERAL
        END DATE     6/75     COMMENTS:
                     THE UTILITY HAS REPORTED THAT A SECOND PERFORMANCE TEST WAS RECENTLY
                     COMPLETED AND PASSED.
        AFFECTED MODULES: SYSTEM

 7/75   SYSTEM                                                                 744

     ** PROBLEMS/SOLUTIONS/COMMENTS
        START DATE   7/75     EQUIPMENT: BOILER-RELATED
        END DATE     9/75     PROBLEM: NOT DEFINED/SPECIFIED
                     ONE OUTAGE UNRELATED TO THE FGD SYSTEM WAS REPORTED FROM JULY THROUGH
                     SEPTEMBER.
        AFFECTED MODULES: SYSTEM

     ** PROBLEMS/SOLUTIONS/COMMENTS
        START DATE   7/75     EQUIPMENT: FGD SYSTEM, GENERAL
        END DATE     9/75     PROBLEM: NOT DEFINED/SPECIFIED
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---------------------------------------PERFORMANCE DATA--------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                     OUTAGES DURING JULY THROUGH SEPTEMBER WERE CAUSED BY SCRUBBER MALFUNCTIONS.
            AFFECTED MODULES: SYSTEM

  8/75  SYSTEM                                                                 744

  9/75  SYSTEM                 78.0                    78.0                    720   716    559

 10/75  SYSTEM                 60.0                    14.0                    744   303    106

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/75      EQUIPMENT: BOILER-RELATED
            END DATE    10/75      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                           LOW OPERATING TIME DURING OCTOBER WAS DUE TO SCHEDULED BOILER MAINTENANCE.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/75      EQUIPMENT: REAGENT HANDLING
            END DATE    10/75      PROBLEM: NOT DEFINED/SPECIFIED
                           ONE OUTAGE WAS DUE TO THE MALFUNCTION OF A SODA ASH BLOWER.
            AFFECTED MODULES: SYSTEM

 11/75  SYSTEM                 60.0                    55.0                    720   654    394

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/75      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    11/75      PROBLEM: NOT DEFINED/SPECIFIED
                           OPERABILITY WAS LOW FOR THE MONTH OF NOVEMBER BECAUSE OF DELAYS IN DELIVER
                           OF REPAIR MATERIALS.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/75      EQUIPMENT: SCRUBBER
            END DATE    11/75      PROBLEM: COMPONENT FAILURE, OTHER
                           THE COLLAPSE OF A VENTURI STRAINER RESULTED IN FGD SYSTEM OUTAGE DURING
                           NOVEMBER.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/75      EQUIPMENT: RECYCLE TANK
            END DATE    11/75      PROBLEM: COMPONENT FAILURE, OTHER
                           REHEATER STEAM LEAKS CAUSED AN OUTAGE DURING NOVEMBER.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/75      EQUIPMENT: PIPING
            END DATE    11/75      PROBLEM: NOT DEFINED/SPECIFIED
                           THE SYSTEM WAS SHUT DOWN FOR 16 DAYS FOR COMPLETION OF PIPING CONVERSION.
                           THIS OUTAGE WAS NOT DUE TO SCRUBBER MALFUNCTION.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/75      EQUIPMENT: REAGENT HANDLING
            END DATE    11/75      PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                           A FROZEN CARBONATE LINE RESULTED IN AN FGD SYSTEM OUTAGE DURING NOVEMBER.
            AFFECTED MODULES: SYSTEM

 12/75  SYSTEM                                                                 744

  1/76  SYSTEM     81.0        29.0        57.0        27.0                    744   647    186

  2/76  SYSTEM     91.0        78.0        89.0        75.0                    696   664    520

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   2/76      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     2/76      PROBLEM: NOT DEFINED/SPECIFIED
                           A DEPLETION OF CHEMICALS DURING FEBRUARY WAS REPORTED.
            AFFECTED MODULES: SYSTEM
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------------------------------------------PERFORMANCE DATA---------------------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER   FGD    CAP.
                                                                SO2  PART. HOURS HOURS  HOURS  FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ -----  ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    2/76      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE      2/76      COMMENTS:
                            FINE SCRUBBER INOPERATIVE PERIODS WERE REPORTED DURING FEBRUARY.  THREE OF
                            THESE OUTAGES WERE NOT RELATED TO THE FGD SYSTEM.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    2/76      EQUIPMENT: PUMP, OTHER
              END DATE      2/76      PROBLEM: NOT DEFINED/SPECIFIED
                            SEAL WATER PROBLEMS WERE REPORTED DURING FEBRUARY.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    2/76      EQUIPMENT: PIPING
              END DATE      2/76      PROBLEM: CHEMICAL-RELATED PLUGGING
                            CHEMICAL LINE PLUGGING PROBLEMS WERE NOTED DURING FEBRUARY.
              AFFECTED MODULES: SYSTEM

 3/76  SYSTEM      99.0        72.0        99.0        39.0                   744   396    287

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    3/76      EQUIPMENT: SCRUBBER
              END DATE      3/76      PROBLEM: NOT DEFINED/SPECIFIED
                            ONE FORCED SCRUBBER OUTAGE WAS CAUSED BY A VENTURI LEAK.
              AFFECTED MODULES: SYSTEM

 4/76  SYSTEM      15.0        91.0       100.0        13.0                   720   106    970

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    4/76      EQUIPMENT: BOILER-RELATED
              END DATE      4/76      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                            THE BOILER WAS TAKEN OUT OF SERVICE IN APRIL FOR INSPECTION OF VALVES AND
                            COAL CONDUITS.
              AFFECTED MODULES: SYSTEM

 5/76  SYSTEM
                                                                              744            0

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    5/76      EQUIPMENT: BOILER-RELATED
              END DATE      7/76      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                            THE UNIT WAS SHUT DOWN FOR A SCHEDULED TURBINE OVERHAUL AND BURNER LINE
                            CONDUIT REPLACEMENT.
              AFFECTED MODULES: SYSTEM

 6/76  SYSTEM
                                                                              720            0
 7/76  SYSTEM
                                                                              744            0
 8/76  SYSTEM      97.0        75.0        94.0        49.0                   744   479    360

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    8/76      EQUIPMENT: THICKENER
              END DATE      8/76      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                            PLUGGING IN THE THICKENER CAUSED AN OUTAGE DURING AUGUST.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    8/76      EQUIPMENT: TANK, OTHER
              END DATE      8/76      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                            PLUGGING IN THE TRAY RECYCLE TANK DURING AUGUST RESULTED IN A FGD OUTAGE.
              AFFECTED MODULES: SYSTEM

 9/76  SYSTEM      95.0        97.0        95.0        89.0                   720   656    639

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    9/76      EQUIPMENT: SPRAY NOZZLES
              END DATE      9/76      PROBLEM: CHEMICAL-RELATED PLUGGING
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-------------------------------------------PERFORMANCE DATA------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD    CAP.
                                                                SO2  PART. HOURS HOURS  HOURS  FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                      PLUGGING IN THE VENTORI SPRAY HEADERS CAUSED A SCRUBBER OUTAGE.
              AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   9/76      EQUIPMENT: FAN
              END DATE     9/76      PROBLEM: NOT DEFINED/SPECIFIED
                      AN I.D. FAN MALFUNCTION RESULTED IN SCRUBBER OUTAGE DURING SEPTEMBER.
              AFFECTED MODULES: SYSTEM

10/76  SYSTEM      98.0        96.0        98.0        87.0                       744   678    648

          ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  10/76      EQUIPMENT: REAGENT HANDLING
              END DATE    10/76      PROBLEM: NOT DEFINED/SPECIFIED
                      SCRUBBER OUTAGE TIME WAS REQUIRED FOR INSTALLATION OF A NEW CARBONATE FEED
                      LINE.
              AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  10/76      EQUIPMENT: PIPING
              END DATE    10/76      PROBLEM: CHEMICAL-RELATED PLUGGING
                      A MINOR SCRUBBER TRIP WAS CAUSED BY PLUGGING IN THE SCRUBBER EFFLUENT
                      SUCTION LINE.
              AFFECTED MODULES: SYSTEM

11/76              87.0        81.0        84.0        71.0
       SYSTEM                                                                     720   631

          ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  11/76      EQUIPMENT: REAGENT HANDLING
              END DATE    11/76      PROBLEM: NOT DEFINED/SPECIFIED
                      ONE FORCED SCRUBBER OUTAGE OCCURRED BECAUSE OF A SCREW CONVEYOR FAILURE,
                      RESULTING IN / INABILITY TO MIX THE CHEMICAL ABSORBENT.
              AFFECTED MODULES: SYSTEM

12/76  SYSTEM      93.0        88.0        92.0        80.0                       744   677    599

          ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  12/76      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE    12/76      PROBLEM: NOT DEFINED/SPECIFIED
                      A FORCED FGD OUTAGE RESULTED FROM CHEMICAL DEPLETION.
              AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  12/76      EQUIPMENT: PROCESS CONTROL
              END DATE    12/76      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                      A PLUGGED SENSING LINE FORCED AN FGD OUTAGE DURING DECEMBER.
              AFFECTED MODULES: SYSTEM

 1/77  SYSTEM      72.0        67.0        87.0        59.0                       744   645    437

          ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   1/77      EQUIPMENT: ABSORBER
              END DATE     1/77
                      RUBBER LINING REPAIRS WERE INITIATED IN THE SEPARATOR SECTION OF THE
                      SCRUBBING MODULE ON JANUARY 22. THE LINING WAS DAMAGED BY A HIGH
                      TEMPERATURE EXCURSION RESULTING FROM A MALFUNCTION IN THE UNIT'S AIR
                      PREHEATER.
              AFFECTED MODULES: SYSTEM

 2/77  SYSTEM                                                                     672   599      0

 3/77  SYSTEM                                                                     744   669      0

 4/77  SYSTEM                                                                     720   400      0

 5/77  SYSTEM                                                                     744   705      0
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------------------------------------------PERFORMANCE DATA------------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD    CAP.
                                                                SO2  PART. HOURS HOURS  HOURS  FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

 6/77  SYSTEM      47.0         45.0        44.0        44.0                       720   701    315

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   6/77     EQUIPMENT: ABSORBER
            END DATE     6/77     COMMENTS:
                         REPAIRS ON THE DAMAGED RUBBER LINING WERE COMPLETED BY MID-JUNE AND THE
                         SYSTEM REMAINED IN SERVICE THROUGHOUT THE MAJORITY OF THE MONTH.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   6/77     EQUIPMENT: PROCESS CONTROL
            END DATE     6/77     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                         A MINOR FORCED OUTAGE RESULTED FROM A HIGH-LOW PRESSURE TRIP CAUSED BY
                         A PLUGGED SENSING LINE.
            AFFECTED MODULES: SYSTEM

 7/77              99.0         99.0        99.0        99.0
       SYSTEM                                                                      744   744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   7/77     EQUIPMENT: ABSORBER
            END DATE     7/77     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                         THE SYSTEM WAS TAKEN OUT OF THE GAS PATH ONLY ONCE DURING THE MONTH
                         BECAUSE OF A SCHEDULED INSPECTION OF THE NEWLY REPLACED RUBBER LINER IN
                         THE SEPARATOR SECTION.
            AFFECTED MODULES: SYSTEM

 8/77  SYSTEM      19.0         21.0        19.0        19.0                       744   662    138

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/77     EQUIPMENT: FAN
            END DATE     8/77     PROBLEM: DESIGN-RELATED VIBRATION
                         I.D. FAN RELAYS WERE INSTALLED BECAUSE OF HIGH FAN VIBRATIONS.
            AFFECTED MODULES: SYSTEM

 9/77  SYSTEM      84.0         73.0        69.0        35.0                       720   343    252

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/77     EQUIPMENT: BOILER-RELATED
            END DATE     9/77     PROBLEM: NOT DEFINED/SPECIFIED
                         THE BOILER WAS OUT OF SERVICE FOR MOST OF THE MONTH.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   0/ 0     EQUIPMENT: GAS DAMPER
            END DATE     9/77     PROBLEM: NOT DEFINED/SPECIFIED
                         THE SCRUBBER HAD LIMIT SWITCH PROBLEMS WITH 14 A & B GUILLOTINE DAMPERS.
            AFFECTED MODULES: SYSTEM

10/77  SYSTEM      99.0         99.0        99.0        86.7                       744   635    630

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/77     EQUIPMENT: FAN
            END DATE    10/77     PROBLEM: NOT DEFINED/SPECIFIED
                         THE UNIT WAS DOWN FOR 5 HOURS DURING OCTOBER TO REPAIR AN I.D. FAN LEAK.
            AFFECTED MODULES: SYSTEM

11/77  SYSTEM      78.7         81.5        78.6        78.1                       720   690    562

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/77     EQUIPMENT: RECYCLE TANK
            END DATE    11/77     PROBLEM: CHEMICAL-RELATED PLUGGING
                         SCREEN PLUGGING IN THE RECYCLE TANK WAS A PROBLEM DURING NOVEMBER.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/77     EQUIPMENT: INSTRUMENTATION
            END DATE    11/77     PROBLEM: NOT DEFINED/SPECIFIED
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----------------------------------------------PERFORMANCE DATA-----------------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                     SCRUBBER INSTRUMENTATION DIFFICULTY WAS EXPERIENCED DURING NOVEMBER.
           AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE  11/77      EQUIPMENT: TANK, OTHER
           END DATE    11/77      PROBLEM: NOT DEFINED/SPECIFIED
                     THE SYSTEM WAS DOWN FOR THE INSTALLATION OF AN OUTLET NOZZLE IN THE
                     BOOSTER TANK.
           AFFECTED MODULES: SYSTEM

12/77             85.0         82.0        83.0         71.0
       SYSTEM                                                                   744   631

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE  12/77      EQUIPMENT: ABSORBER
           END DATE    12/77      PROBLEM: NOT DEFINED/SPECIFIED
                     TWO OUTAGES WERE CAUSED BY HIGH TRAY DIFFERENTIAL PRESSURE.
           AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE  12/77      EQUIPMENT: FAN
           END DATE    12/77      PROBLEM: NOT DEFINED/SPECIFIED
                     ELECTRICAL PROBLEMS IN THE 1A FORCED DRAFT FAN CAUSED AN FGD SYSTEM
                     OUTAGE.
           AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE  12/77      EQUIPMENT: ABSORBER
           END DATE    12/77      PROBLEM: NOT DEFINED/SPECIFIED
                     THE SCRUBBER WAS OFF-LINE FOR APPROXIMATELY 109 HOURS DUE TO HIGH TRAY
                     DIFFERENTIAL PRESSURE AND SOME PLUGGING IN THE I.D. FAN SENSING LINE.
           AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE  12/77      EQUIPMENT: GAS DAMPER
           END DATE    12/77      PROBLEM: NOT DEFINED/SPECIFIED
                     THE BOILER WAS DOWN ABOUT 113 HOURS IN DECEMBER.
           AFFECTED MODULES: SYSTEM SYSTEM

1/78   SYSTEM     56.0         68.0        69.0         56.0                    744   616   416

2/78   SYSTEM     97.0         75.0        94.0         43.0                    672   389   292

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   2/78      EQUIPMENT: DUCTWORK
           END DATE     2/78      PROBLEM: NOT DEFINED/SPECIFIED
                     A DUCT HI-LO PRESSURE TRIP CONTRIBUTED TO THE FEBRUARY OUTAGE TIME.
           AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   2/78      EQUIPMENT: BOILER-RELATED
           END DATE     3/78      PROBLEM: NOT DEFINED/SPECIFIED
                     THE BOILER WENT OUT OF SERVICE ON FEBRUARY 17 FOR A THREE WEEK OUTAGE.
           AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   2/78      EQUIPMENT: PROCESS CONTROL
           END DATE     2/78      PROBLEM: CHEMICAL-RELATED PLUGGING
                     PLUGGED SENSING LINES CONTRIBUTED TO THE OUTAGE TIME DURING FEBRUARY.
           AFFECTED MODULES: SYSTEM

3/78   SYSTEM     28.0         58.0        58.0         28.0                    744   355   207

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   3/78      EQUIPMENT: BOILER-RELATED
           END DATE     3/78      PROBLEM: NOT DEFINED/SPECIFIED
                     THE BOILER WAS OFF LINE UNTIL MARCH 16.
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------------------------------------------PERFORMANCE DATA-----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER   FGD    CAP.
                                                                SO2  PART. HOURS HOURS   HOURS  FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ------ ------
           AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    3/78      EQUIPMENT: RECYCLE TANK
           END DATE      3/78      PROBLEM: NOT DEFINED/SPECIFIED
                                   A PROBLEM WAS ENCOUNTERED WITH THE REHEAT STEAM REGULATOR DURING MARCH
           AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    3/78      EQUIPMENT: GAS DAMPER
           END DATE      3/78      PROBLEM: NOT DEFINED/SPECIFIED
                                   PROBLEMS WITH THE GUILLOTINE SWITCHES DELAYED START-UP OF THE FGD SYSTEM
                                   UNTIL MARCH 22.
           AFFECTED MODULES: SYSTEM

 4/78  SYSTEM      100.0        97.0       100.0        75.0                          720   560    541

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    4/78      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE      4/78      COMMENTS:
                                   THERE WERE NO FGD SYSTEM FORCED OUTAGES.  ALL DOWNTIME WAS BOILER
                                   RELATED.
           AFFECTED MODULES: SYSTEM

 5/78  SYSTEM       97.0        92.0        96.0        78.0                          744   630    582

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    5/78      EQUIPMENT: BOILER-RELATED
           END DATE      5/78      PROBLEM: NOT DEFINED/SPECIFIED
                                   REPAIRS TO THE CONDENSER AND PRODUCTION CONTROL CONTRIBUTED CONTRIBUTED
                                   TO BOILER OUTAGES.
           AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    5/78      EQUIPMENT: FAN
           END DATE      5/78      PROBLEM: NOT DEFINED/SPECIFIED
                                   HIGH TEMPERATURE ON AN I.D. FAN BEARING CAUSED AN OUTAGE.
           AFFECTED MODULES: SYSTEM

 6/78  SYSTEM       89.0        89.0       100.0        89.0                          720   720    644

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    6/78      EQUIPMENT: SCRUBBER
           END DATE      6/78      PROBLEM: NOT DEFINED/SPECIFIED
                                   THERE WAS ONE SCHEDULED FGD OUTAGE TO REPAIR A LEAK ON THE VENTURI WATER
                                   BOX.
           AFFECTED MODULES: SYSTEM

 7/78  SYSTEM      100.0        99.0       100.0        99.0                          744   744    736

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    7/78      EQUIPMENT: ABSORBER
           END DATE      7/78      PROBLEM: NOT DEFINED/SPECIFIED
                                   A SCHEDULED FGD OUTAGE WAS REQUIRED TO RECTIFY A HIGH TRAY DIFFERENTIAL
                                   PRESSURE PROBLEM.  THE TRAY WAS CLEANED OUT DURING THE OUTAGE.
           AFFECTED MODULES: SYSTEM

 8/78  SYSTEM       94.0        94.0        93.0        89.0                          744   706    661

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    8/78      EQUIPMENT: ABSORBER
           END DATE      8/78      PROBLEM: NOT DEFINED/SPECIFIED
                                   THE SCRUBBER WAS FORCED OFF LINE ON AUGUST 5 BECAUSE OF A LOSS OF THE
                                   ASH PANEL CONTROL POWER.  THIS LEFT THE UNIT WITHOUT EMERGENCY SPRAY TO
                                   THE SCRUBBERS.
           AFFECTED MODULES: SYSTEM
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------------------------------------------PERFORMANCE DATA----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD    CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   8/78     EQUIPMENT: SCRUBBER
              END DATE     8/78     PROBLEM: NOT DEFINED/SPECIFIED
                           A FORCED OUTAGE OCCURRED ON AUGUST 20 WHEN THERE WAS A SCRUBBER VENTURI
                           HIGH TEMPERATURE ALARM.  THE EXACT CAUSE WAS NOT KNOWN BUT A BOILER TUBE
                           LEAK WAS SUSPECTED.
              AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   8/78     EQUIPMENT: ABSORBER
              END DATE     8/78     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                           THERE WAS ONE SCHEDULED OUTAGE DURING THE MONTH TO CLEAN THE TRAY.
              AFFECTED MODULES: SYSTEM

 9/78  SYSTEM     99.0         97.0        99.0        87.0                         720   644    626

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   9/78     EQUIPMENT: BOILER-RELATED
              END DATE     9/78     PROBLEM: NOT DEFINED/SPECIFIED
                           THERE WERE THREE BOILER RELATED OUTAGES DURING SEPTEMBER.  A BOILER TUBE
                           LEAK AND BOILER BURNER WERE REPAIRED.
              AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   9/78     EQUIPMENT: GAS DAMPER
              END DATE     9/78     PROBLEM: DESIGN-RELATED PRESSURE SURGES
                           DURING THE MONTH A BOILER TRIP OCCURRED WHICH WAS CAUSED BY SCRUBBER
                           HIGH DUCT PRESSURE.
              AFFECTED MODULES: SYSTEM

10/78  SYSTEM    100.0        100.0       100.0        90.0                         744   667    667

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  10/78     EQUIPMENT: BOILER-RELATED
              END DATE    10/78     PROBLEM: NOT DEFINED/SPECIFIED
                           THE BOILER WAS OFF LINE FOR ABOUT 77 HOURS FOR REMOVAL OF AN ASH CLINKER.
              AFFECTED MODULES: SYSTEM

11/78  SYSTEM    100.0        100.0       100.0        90.0                         720          598

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  11/78     EQUIPMENT: INSTRUMENTATION
              END DATE    11/78     PROBLEM: NOT DEFINED/SPECIFIED
                           THE FGD SYSTEM WAS DOWN FOR SCRUBBER OUTLET TEMPERATURE PROBE REPAIRS.
              AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  11/78     EQUIPMENT: BOILER-RELATED
              END DATE    11/78     PROBLEM: NOT DEFINED/SPECIFIED
                           OUTAGE TIME RESULTED WHEN BOILER PROBLEMS CAUSED THE VENTURI OUTLET GAS
                           TEMPERATURE TO BECOME TO HIGH (TEMPERATURE ALARM HIGH TRIP).
              AFFECTED MODULES: SYSTEM

12/78  SYSTEM     95.6         92.8        92.9        92.0                         744   737    684

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  12/78     EQUIPMENT: SCRUBBER
              END DATE    12/78     PROBLEM: NOT DEFINED/SPECIFIED
                           THE SCRUBBING SYSTEM WAS OUT OF SERVICE TO REPAIR A LEAK IN A VENTURI
                           LINE.
              AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  12/78     EQUIPMENT: SCRUBBER
              END DATE    12/78     PROBLEM: NOT DEFINED/SPECIFIED
                           THE FGD SYSTEM WAS DOWN TO CLEAN THE VENTURI RACE TRACK AND CLEAN PRESSURE
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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------------------------------------------PERFORMANCE DATA-----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                        SENSING LINES.
          AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  12/78      EQUIPMENT:
          END DATE    12/78      PROBLEM: NOT DEFINED/SPECIFIED
                        THE BOILER WAS OFF LINE APPROXIMATELY 1 DAY FOR PULVERIZER REPAIRS.
          AFFECTED MODULES: SYSTEM

 1/79  SYSTEM      83.9        73.7        73.7        67.0                    744   681    502

       ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE   1/79      EQUIPMENT: BOILER-RELATED
          END DATE     1/79      PROBLEM: NOT DEFINED/SPECIFIED
                        THE BOILER WAS DOWN ABOUT 5 DAYS TO REMOVE A CLINKER FROM THE BOTTON
                        HOPPER.
          AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE   1/79      EQUIPMENT: PUMP, OTHER
          END DATE     1/79      PROBLEM: NOT DEFINED/SPECIFIED
                        A FORCED OUTAGE WAS CAUSED WHEN THE 2C LOAD CENTER TRIPPED RESULTING IN
                        LOSS OF POWER TO TRAY SPRAY PUMP.  REPAIRS WERE MADE ON THE TRAY AND SPRAY
                        SYSTEMS.
          AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE   1/79      EQUIPMENT: FAN
          END DATE     1/79      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                        THE FGD SYSTEM WAS DOWN FOR A SHORT PERIOD TO INSPECT THE BEARING ON THE
                        I.D. FAN.
          AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE   1/79      EQUIPMENT: SCRUBBER
          END DATE     1/79      PROBLEM: NOT DEFINED/SPECIFIED
                        THE FGD SYSTEM WAS DOWN TO REPAIR A LEAK IN THE VENTURI LINE.
          AFFECTED MODULES: SYSTEM

 2/79  SYSTEM      85.6        85.9        85.9        85.6                    672   670    575

       ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE   2/79      EQUIPMENT: SCRUBBER
          END DATE     2/79      PROBLEM: NOT DEFINED/SPECIFIED
                        THE FGD SYSTEM WAS DOWN TO CLEAN THE VENTURI RACE TRACK NOZZLES, CLEAN THE
                        EFFLUENT LINE AND REPAIR LEAK IN VENTURI LINE.
          AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE   2/79      EQUIPMENT: PIPING
          END DATE     2/79      PROBLEM: NOT DEFINED/SPECIFIED
                        A BREAK IN THE ASH CIRCULATING WATER LINE RESULTING IN LOSS OF EMERGENCY
                        COOLING WATER FORCED THE FGD SYSTEM OFF LINE.
          AFFECTED MODULES: SYSTEM
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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COMPANY NAME                                    NEVADA POWER
PLANT NAME                                      REID GARDNER
UNIT NUMBER                                     2
CITY                                            MOAPA
STATE                                           NEVADA
REGULATORY CLASSIFICATION                       A
PARTICULATE EMISSION LIMITATION - NG/J            43.          (  .100 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                  ******         (****** LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW              *******
GROSS UNIT GENERATING CAPACITY - MW               125.0
NET UNIT GENERATING CAPACITY W/FGD - MW           110.0
NET UNIT GENERATING CAPACITY WO/FGD - MW        *******
EQUIVALENT SCRUBBED CAPACITY - MW                 125.0

** BOILER DATA
     SUPPLIER                                   FOSTER WHEELER
     TYPE                                       PULVERIZED COAL, WET BOTTOM
     SERVICE LOAD                               BASE
     COMMERCIAL SERVICE DATE                     0/68
     MAXIMUM BOILER FLUE GAS FLOW - CU.M/S        223.21       ( 473000 ACFM)
     FLUE GAS TEMPERATURE - C                     176.7        ( 350 F)
     STACK HEIGHT - M                              61.         ( 200 FT)
     STACK TOP DIAMETER - M                     *******        (***** FT)

** FUEL DATA
     FUEL TYPE                                  COAL
     FUEL GRADE                                 ******
     AVERAGE HEAT CONTENT - KJ/KG                28842.        ( 12400 BTU/LB)
     RANGE HEAT CONTENT - BTU/LB                                 ******
     AVERAGE ASH CONTENT - %                          8.00
     RANGE ASH CONTENT - %                      8.-10.
     AVERAGE MOISTURE CONTENT - %               ********
     RANGE MOISTURE CONTENT - %                 5-6
     AVERAGE SULFUR CONTENT - %                        .50
     RANGE SULFUR CONTENT - %                   0.5-1.0
     AVERAGE CHLORIDE CONTENT - %               ********
     RANGE CHLORIDE CONTENT - %                 ******
     FUEL FIRING RATE - M T/H                   *******        (*** TPH)
     FUEL FIRING RATE - MW                      *****

** MECHANICAL COLLECTOR
     TYPE                                       MULTICLONES
     SUPPLIER                                   RESEARCH COTTRELL

** PARTICULATE SCRUBBER
     NUMBER                                      2
     TYPE                                       VARIABLE THROAT VENTURI
     SUPPLIER                                   ADL/COMBUSTION EQUIP ASSOCIATES
     LINING MATERIAL                            INCOLOY 825
     TYPE OF NOZZLES                            TANGENTIAL
     BOILER LOAD/SCRUBBER - %                     50.0
     LIQUID RECIRCULATION RATE - LITER/S         157.5         ( 2500 GPM)
     L/G RATIO - LITER/CU.M                        1.3         (10.0 GAL/1000ACF)
     PRESSURE DROP - KPA                           3.7         (   15 IN-H2O)
     SO2 INLET CONCENTRATION - PPM               375.000

** FGD SYSTEM
     SALEABLE PRODUCT/THROWAWAY PRODUCT         THROWAWAY PRODUCT
     GENERAL PROCESS TYPE                       WET SCRUBBING
     PROCESS TYPE                               SODIUM CARBONATE
     SYSTEM SUPPLIER                            ADL/COMBUSTION EQUIP ASSOCIATE
     A-E FIRM                                   BECHTEL
     DEVELOPMENT LEVEL                          FULL-SCALE
     NEW/RETROFIT                               RETROFIT
     PARTICULATE DESIGN REMOVAL EFFICIENCY - %    97.00
     SO2 DESIGN REMOVAL EFFICIENCY - %            90.00
     INITIAL START-UP                            4/74

** ABSORBER
     NUMBER                                      1
     TYPE                                       PERFERATED PLATE WASHING TOWER
     INITIAL START UP                            4/74
     NUMBER OF STAGES                              1
     DIMENSIONS                                 30 DIA.
     BOILER LOAD/ABSORBER - %                     100.0
     L/G RATIO - L/CU.M                              .2        (  1.6 GAL/1000ACF)
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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     SO2 OUTLET CONTRATION - PPM                      17

  ** FANS
       NUMBER                                         1
       TYPE                                          I.D. BOOSTER FAN
       CONSTRUCTION MATERIALS                        CARBON STEEL

  ** MIST ELIMINATOR
       NUMBER                                         1
       TYPE                                          RADIAL VANE
       CONSTRUCTION MATERIAL                         316L SS
       CONFIGURATION                                 HORIZONTAL
       WASH SYSTEM                                   NONE
       PRESSURE DROP - KPA                               .1        (  .5 IN-H2O)

  ** TANKS
       SERVICE                                       NUMBER
       -------                                       ------
       VENTURI RECYCLE                               ****

  ** REHEATER
       TYPE                                          INDIRECT HOT AIR
       HEATING MEDIUM                                STEAM
       TEMPERATURE BOOST - C                            16.7        (   30 F)
       ENERGY REQUIRED                               15.2 MM BTU/H (RATING), 4 MW

  ** WATER LOOP
       TYPE                                          OPEN
       FRESH MAKEUP WATER ADDITION - LITERS/S           1.6         (   25 GPM)

  ** DISPOSAL
       NATURE                                        FINAL
       TYPE                                          EVAP POND
       LOCATION                                      ON-SITE
       TRANSPORTATION                                GRAVITY FLOW FROM INTERIM SLUDGE POND
       AREA - ACRES                                     45.0

  ** DISPOSAL
       NATURE                                        INTERIM
       TYPE                                          1 POND (SHARED WIT
       LOCATION                                      ON-SITE
       AREA - ACRES                                      6.0


-------------------------------------------PERFORMANCE DATA-----------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

 4/74  SYSTEM                                                                720

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    4/74     EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE      4/74     COMMENTS:
                         THE FGD SYSTEM WAS PLACED IN SERVICE IN APRIL 1974.  THE SCRUBBING SYSTEM
                         DESIGN WAS BASED ON INFORMATION AND DATA OBTAINED FROM AN 8000-ACFM PILOT
                         PLANT PROGRAM CONDUSTED AT REID GARDNER IN 1971 AND 1972.
           AFFECTED MODULES: SYSTEM

 2/75  SYSTEM                  90.0                                          672          0

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    2/75     EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE      6/75     PROBLEM: NOT DEFINED/SPECIFIED
                         ROUTINE MECHANICAL PROBLEMS WERE ENCOUNTERED.
           AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    2/75     EQUIPMENT: INSTRUMENTATION
           END DATE      6/75     PROBLEM: NOT DEFINED/SPECIFIED
                         ROUTINE INSTRUMENTAL PROBLEMS WERE EXPERIENCED.
           AFFECTED MODULES: SYSTEM
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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------------------------------------------PERFORMANCE DATA-------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    2/75      EQUIPMENT: PIPING
            END DATE      6/75      PROBLEM: CHEMICAL-RELATED EROSION
                          ABRASION OF RUBBER-LINED PIPES WERE A PROBLEM.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    2/75      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE      6/75      COMMENTS:
                          A SECOND PERFORMANCE TEST WAS PASSED.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    2/75      EQUIPMENT: BOILER-RELATED
            END DATE      6/75      PROBLEM: NOT DEFINED/SPECIFIED
                          THE UNIT WAS RESTARTED AFTER SHUTDOWN FOR 5-YEAR TURBINE OVERHAUL.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    2/75      EQUIPMENT: PUMP, OTHER
            END DATE      6/75      PROBLEM: NOT DEFINED/SPECIFIED
                          SEAL WATER FILTERS WERE A PROBLEM.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    2/75      EQUIPMENT: BOILER-RELATED
            END DATE      6/75      PROBLEM: NOT DEFINED/SPECIFIED
                          BOILER CONTROLS WERE A PROBLEM.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    2/75      EQUIPMENT: RECYCLE TANK
            END DATE      6/75      PROBLEM: NOT DEFINED/SPECIFIED
                          A PLUGGED RECYCLE LINE STRAIN   WAS A PROBLEM.
            AFFECTED MODULES: SYSTEM

 3/75  SYSTEM                                                                   744

 4/75  SYSTEM                                                                   720

 5/75  SYSTEM                                                                   744

 6/75  SYSTEM                                                                   720

 7/75  SYSTEM                  85.0                                             744          0

 8/75  SYSTEM                                                                   744
      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    8/75      EQUIPMENT: REAGENT HANDLING
            END DATE      9/75      PROBLEM: NOT DEFINED/SPECIFIED
                          A BROKEN BUCKET ELEVATOR CONTRIBUTED TO A FORCED FGD OUTAGE.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    8/75      EQUIPMENT: PIPING
            END DATE      9/75      PROBLEM: CHEMICAL-RELATED EROSION
                          WORN RECIRCULATION PIPING CONTRIBUTED TO FORCED FGD OUTAGE.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    8/75      EQUIPMENT: ABSORBER
            END DATE      9/75      PROBLEM: NOT DEFINED/SPECIFIED
                          RUBBER LINER LEAKAGE CONTRIBUTED TO FORCED FGD OUTAGE.
            AFFECTED MODULES: SYSTEM
```

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------------------------------------------PERFORMANCE DATA------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD    CAP.
                                                                SO2  PART. HOURS HOURS  HOURS  FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ -----  ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/75      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     9/75      PROBLEM: NOT DEFINED/SPECIFIED
                              STRAINER PLUGGING CONTRIBUTED TO FORCED FGD OUTAGE TIME.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/75      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     9/75      PROBLEM: NOT DEFINED/SPECIFIED
                              THREE FORCED OUTAGES OCCURRED DURING AUGUST AND SEPTEMBER.
            AFFECTED MODULES: SYSTEM

 9/75  SYSTEM                  77.0                     69.0                       720   645    496

10/75  SYSTEM                  87.0                     62.0                       744   531    464

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/75      EQUIPMENT: PUMP, OTHER
            END DATE    10/75
                              PUMP REPAIR NECESSITATED AN FGD OUTAGE.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/75      EQUIPMENT: INSTRUMENTATION
            END DATE    10/75      PROBLEM: NOT DEFINED/SPECIFIED
                              INSTRUMENT PLUGGING CAUSED AN FGD OUTAGE.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/75      EQUIPMENT: PIPING
            END DATE    10/75      PROBLEM: NOT DEFINED/SPECIFIED
                              REPAIR OF PIPING LEAKAGE NECESSITATED AN FGD OUTAGE.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/75      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    10/75      PROBLEM: NOT DEFINED/SPECIFIED
                              THREE FORCED SCRUBBER OUTAGES WERE REPORTED FOR OCTOBER.
            AFFECTED MODULES: SYSTEM

11/75  SYSTEM                  99.0                     83.0                       720   603    596

12/75  SYSTEM                                                                      744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/75      EQUIPMENT: PIPING
            END DATE     1/76      PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                              FROZEN CARBONATE LINES CONTRIBUTED TO FGD OUTAGE TIME.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/75      EQUIPMENT: PROCESS CONTROL
            END DATE     1/76      PROBLEM: NOT DEFINED/SPECIFIED
                              PLUGGED PRESSURE-SENSING LINES CONTRIBUTED TO FGD OUTAGE TIME.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/75      EQUIPMENT: DUCTWORK
            END DATE     1/76      PROBLEM: DESIGN-RELATED PRESSURE SURGES
                              DUCT PRESSURE TRIPS CONTRIBUTED TO FGD OUTAGE TIME.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/75      EQUIPMENT: PUMP, OTHER
            END DATE     1/76      PROBLEM: NOT DEFINED/SPECIFIED
                              OVERHAUL OF A TRAY RECYCLE PUMP CONTRIBUTED TO FGD OUTAGE TIME.
```

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                                   SECTION 3
                 DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
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-----------------------------------------PERFORMANCE DATA---------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
              AFFECTED MODULES: SYSTEM

 1/76  SYSTEM     72.0        66.0        66.0        62.0                  744   691   458

 2/76  SYSTEM     84.0        86.0        86.0        83.0                  696   675   578

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   2/76     EQUIPMENT: PUMP, OTHER
            END DATE     2/76     PROBLEM: NOT DEFINED/SPECIFIED
                         PLUGGING IN A VENTURI PUMP CONTRIBUTED TO FGD OUTAGE TIME.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   2/76     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     2/76     PROBLEM: NOT DEFINED/SPECIFIED
                         CHEMICAL DEPLETION CONTRIBUTED TO FGD OUTAGE TIME.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   2/76     EQUIPMENT: PUMP, OTHER
            END DATE     2/76     PROBLEM: NOT DEFINED/SPECIFIED
                         SEAL WATER PROBLEMS CONTRIBUTED TO FGD OUTAGE TIME.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   2/76     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     2/76     PROBLEM: NOT DEFINED/SPECIFIED
                         THE UTILITY REPORTED FOUR SCRUBBER INACTIVE PERIODS DURING FEBRUARY, THREE
                         OF WHICH WERE SCRUBBER-RELATED OUTAGES.
            AFFECTED MODULES: SYSTEM

 3/76  SYSTEM     67.0        60.0        62.0        53.0                  744   660   395

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   3/76     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     3/76     PROBLEM: NOT DEFINED/SPECIFIED
                         TWO FGD FORCED OUTAGES OCCURRED DURING MARCH.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   3/76     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     3/76     PROBLEM: NOT DEFINED/SPECIFIED
                         AN ELECTRICAL FAILURE RESULTED IN AN FGD SYSTEM OUTAGE.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   3/76     EQUIPMENT: ABSORBER
            END DATE     3/76     PROBLEM: CHEMICAL-RELATED PLUGGING
                         PLUGGING IN THE TRAY SYSTEM RESULTED IN A SUBSEQUENT OVERHAUL OF THE TRAY
                         CYCLE PUMPS.  THIS CAUSED FGD OUTAGE TINME.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   3/76     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     3/76     PROBLEM: NOT DEFINED/SPECIFIED
                         TWO FORCED SCRUBBER OUTAGES WERE REPORTED FOR MARCH.
            AFFECTED MODULES: SYSTEM

 4/76  SYSTEM     85.0        77.0        83.0        68.0                  720   629   488

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   4/76     EQUIPMENT: INSTRUMENTATION
            END DATE     4/76     PROBLEM: CHEMICAL-RELATED PLUGGING
                         PLUGGED SENSING LINES RESULTED IN FGD OUTAGE TIME.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   4/76     EQUIPMENT: RECYCLE TANK
            END DATE     4/76     PROBLEM: NOT DEFINED/SPECIFIED
```

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-------------------------------------------PERFORMANCE DATA----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                               SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                          A REHEATER LEAK RESULTED IN FGD OUTAGE TIME.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   4/76      EQUIPMENT: SCRUBBER
             END DATE     4/76      PROBLEM: NOT DEFINED/SPECIFIED
                          VENTURI SPOOL RECYCLE REPLACEMENT REQUIRED FGD OUTAGE TIME.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   4/76      EQUIPMENT: TANK, OTHER
             END DATE     4/76      PROBLEM: NOT DEFINED/SPECIFIED
                          TANK PATCHING REQUIRED  FGD OUTAGE TIME.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   4/76      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     4/76      PROBLEM: NOT DEFINED/SPECIFIED
                          FOUR FORCED SCRUBBER OUTAGES WERE REPORTED BY THE UTILITY FOR APRIL.
             AFFECTED MODULES: SYSTEM

 5/76  SYSTEM     99.0        83.0        98.0        79.0                     744            0

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   5/76      EQUIPMENT: SCRUBBER
             END DATE     5/76
                          PLUGGED VENTURI LINES WERE A PROBLEM.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   5/76      EQUIPMENT: INSTRUMENTATION
             END DATE     5/76      PROBLEM: CHEMICAL-RELATED PLUGGING
                          A PLUGGED SENSING LINE WAS A PROBLEM.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   5/76      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     5/76      COMMENTS:
                          TOTAL SCRUBBER OPERATION TIME TO DATE IS 9488 HOURS.
             AFFECTED MODULES: SYSTEM

 6/76  SYSTEM                                                                  720

 7/76  SYSTEM     91.0        81.0        96.0        57.0                     744   518    421

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   7/76      EQUIPMENT: SCRUBBER
             END DATE     7/76      PROBLEM: NOT DEFINED/SPECIFIED
                          A PROBLEM WITH A HIGH SOLIDS CONCENTRATION IN THE VENTURI SCRUBBING CYCLE
                          CONTRIBUTED TO FGD OUTAGE TIME.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   7/76      EQUIPMENT: PIPING
             END DATE     7/76      PROBLEM: NOT DEFINED/SPECIFIED
                          THE REPLACEMENT OF A RUBBER-LINED PIPE IN THE VENTURI SCRUBBER CONTRIBUTED
                          TO FGD OUTAGE TIME.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   7/76      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     7/76      PROBLEM: NOT DEFINED/SPECIFIED
                          TWO SCRUBBER OUTAGES WERE REPORTED DURING JULY.
             AFFECTED MODULES: SYSTEM

 8/76  SYSTEM     95.0        75.0        94.0        71.0                     744   709    530
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---------------------------------------------PERFORMANCE DATA-------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                               SO2  PART.  HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    8/76      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE      8/76      PROBLEM: NOT DEFINED/SPECIFIED
                          DEPLETION OF CHEMICAL ABSORBENT (TRONA) CONTRIBUTED TO FGD OUTAGE TIME.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    8/76      EQUIPMENT: BOILER-RELATED
            END DATE      8/76      PROBLEM: NOT DEFINED/SPECIFIED
                          BOILER TRIPS CONTRIBUTED TO FGD OUTAGE TIME.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    8/76      EQUIPMENT: SCRUBBER
            END DATE      8/76      PROBLEM: NOT DEFINED/SPECIFIED
                          LEAKAGE IN THE VENTURI RECYCLE LINE CONTRIBUTED TO FGD OUTAGE TIME.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    8/76      EQUIPMENT: THICKENER
            END DATE      8/76      PROBLEM: PLUGGING, OTHER
                          PLUGGING IN THE THICKENER CONTRIBUTED TO FGD OUTAGE TIME.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    8/76      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE      8/76      PROBLEM: NOT DEFINED/SPECIFIED
                          FORCED OUTAGE TIME TOTALED 34.5 HOURS FOR THE FGD SYSTEM.
            AFFECTED MODULES: SYSTEM

 9/76  SYSTEM      94.0        96.0        94.0        91.0                         720   681   653

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    9/76      EQUIPMENT: FAN
            END DATE      9/76      PROBLEM: NOT DEFINED/SPECIFIED
                          MINOR TRIPS WERE CAUSED BY PLUGGING IN THE I.D. FAN REFERENCE LINES.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    9/76      EQUIPMENT: INSTRUMENTATION
            END DATE      9/76      PROBLEM: NOT DEFINED/SPECIFIED
                          A MINOR SYSTEM TRIP WAS CAUSED BY A FALSE HIGH TEMPERATURE READING IN
                          THE VENTURI CAUSED BY WATER IN THE INSTRUMENT.
            AFFECTED MODULES: SYSTEM

10/76  SYSTEM      95.0        95.0        95.0        88.0                         744   694   656

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   10/76      EQUIPMENT: GAS DAMPER
            END DATE     10/76      PROBLEM: NOT DEFINED/SPECIFIED
                          SCRUBBER TRIPS WERE CAUSED BY VENTURI GAS DAMPER PROBLEMS.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   10/76      EQUIPMENT: PIPING
            END DATE     10/76      PROBLEM: NOT DEFINED/SPECIFIED
                          REPLACEMENT OF THE CARBONATE FEED LINE CONTRIBUTED TO FGD OUTAGE TIME.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   10/76      EQUIPMENT: PIPING
            END DATE     10/76      PROBLEM: CHEMICAL-RELATED PLUGGING
                          PLUGGING IN THE SCRUBBER EFFLUENT LINE CONTRIBUTED TO FGD OUTAGE TIME.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   10/76      EQUIPMENT: BOILER-RELATED
            END DATE     10/76      PROBLEM: NOT DEFINED/SPECIFIED
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-----------------------------------------PERFORMANCE DATA--------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                               SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                         SCRUBBER OUTAGE TIME DUE TO BOILER TRIPS AMOUNTED TO APPROXIMATELY 65
                         HOURS.
                 AFFECTED MODULES: SYSTEM

11/76  SYSTEM       52.0        58.0        51.0        50.0                      720   621    363

12/76  SYSTEM                                                                     744   275      0

          ** PROBLEMS/SOLUTIONS/COMMENTS
                 START DATE  12/76     EQUIPMENT: BOILER-RELATED
                 END DATE    12/76     PROBLEM: NOT DEFINED/SPECIFIED
                         THE BOILER WAS DOWN FOR REPAIR OF A CONDENSER TUBE LEAK AND BOTTOM ASH
                 AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
                 START DATE  12/76     EQUIPMENT: GAS DAMPER
                 END DATE    12/76     PROBLEM: NOT DEFINED/SPECIFIED
                         DURING THE BOILER OUTAGE THE SCRUBBER'S GUILLOTINE DAMPERS WERE BADLY
                         DAMAGED.  THE SCRUBBER REMAINED OUT OF SERVICE DURING THE MONTH OF
                         DECEMBER.
                 AFFECTED MODULES: SYSTEM

 1/77  SYSTEM                                                                     744            0

          ** PROBLEMS/SOLUTIONS/COMMENTS
                 START DATE   1/77     EQUIPMENT: BOILER-RELATED
                 END DATE     1/77     PROBLEM: NOT DEFINED/SPECIFIED
                         THE BOILER WAS OFF LINE DURING JANUARY FOR MAINTENANCE.
                 AFFECTED MODULES: SYSTEM

 2/77  SYSTEM       93.0        75.0        88.0        56.0                      672   516    387

          ** PROBLEMS/SOLUTIONS/COMMENTS
                 START DATE   2/77     EQUIPMENT: SCRUBBER
                 END DATE     2/77     PROBLEM: NOT DEFINED/SPECIFIED
                         A MINOR SCRUBBER OUTAGE RESULTED FROM A VENTURI PIPING LEAK.
                 AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
                 START DATE   2/77     EQUIPMENT: FGD SYSTEM, GENERAL
                 END DATE     2/77     PROBLEM: NOT DEFINED/SPECIFIED
                         AT THE END OF FEBRUARY THERE WERE SOME ELECTRICAL PROBLEMS.
                 AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
                 START DATE   2/77     EQUIPMENT: TANK, OTHER
                 END DATE     2/77     PROBLEM: NOT DEFINED/SPECIFIED
                         A MINOR SCRUBBER OUTAGE WAS REQUIRED TO CLEAN THE WASH TRAY RECYCLE TANK.
                 AFFECTED MODULES: SYSTEM

 3/77  SYSTEM       92.0        86.0        97.0        76.0                      744   659    567

          ** PROBLEMS/SOLUTIONS/COMMENTS
                 START DATE   3/77     EQUIPMENT: ABSORBER
                 END DATE     3/77     PROBLEM: CHEMICAL-RELATED PLUGGING
                         A PLUGGED SPRAY TRAY CONTRIBUTED TO FGD OUTAGE TIME.
                 AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
                 START DATE   3/77     EQUIPMENT: FGD SYSTEM, GENERAL
                 END DATE     3/77     PROBLEM: NOT DEFINED/SPECIFIED
                         ELECTRICAL PROBLEMS CONTRIBUTED TO FGD OUTAGE TIME.
                 AFFECTED MODULES: SYSTEM

          ** PROBLEMS/SOLUTIONS/COMMENTS
                 START DATE   3/77     EQUIPMENT: GAS DAMPER
                 END DATE     3/77     PROBLEM: DESIGN-RELATED PRESSURE SURGES
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                                          SECTION 3
                         DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
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---------------------------------------------PERFORMANCE DATA-----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                          DUCT PRESSURE SWINGING CONTRIBUTED TO FGD OUTAGE TIME.
          AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE    3/77      EQUIPMENT: FAN
          END DATE      3/77      PROBLEM: NOT DEFINED/SPECIFIED
                        AN I.D. FAN SWING CONTRIPUTED TO FGD OUTAGE TIME.
          AFFECTED MODULES: SYSTEM

 4/77  SYSTEM       95.0         95.0         95.0         95.0                       720   720    685

      ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE    4/77      EQUIPMENT: SCRUBBER
          END DATE      4/77      PROBLEM: NOT DEFINED/SPECIFIED
                        FORCED FGD OUTAGE TIME RESULTED FROM A LEAK IN THE VENTURI DISCHARGE LINE.
          AFFECTED MODULES: SYSTEM

 5/77  SYSTEM       99.0         85.0         98.0         60.0                       744   524    445

      ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE    5/77      EQUIPMENT: BOILER-RELATED
          END DATE      5/77      PROBLEM: NOT DEFINED/SPECIFIED
                        ONE BOILER OUTAGE OCCURRED DURING MAY.
          AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE    5/77      EQUIPMENT: PUMP, OTHER
          END DATE      5/77      PROBLEM: NOT DEFINED/SPECIFIED
                        THE ASH SERVICE PUMPS WERE OUT OF SERVICE FOR APPROXIMATELY 10 HOURS
                        RESULTING IN NO EMERGENCY SPRAY THUS FORCING THE FGD SYSTEM OUT OF SERVICE
          AFFECTED MODULES: SYSTEM

 6/77  SYSTEM       94.0         93.0         94.0         83.0                       720   639    596

      ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE    6/77      EQUIPMENT: FGD SYSTEM, GENERAL
          END DATE      6/77      COMMENTS:
                        THREE FORCED SCRUBBER OUTAGES WERE REPORTED IN JUNE.
          AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE    6/77      EQUIPMENT: INSTRUMENTATION
          END DATE      6/77      PROBLEM: CHEMICAL-RELATED PLUGGING
                        ONE FORCED OUTAGE WAS DUE TO PLUGGING OF THE I.D. FAN SENSING LINE.
          AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE    6/77      EQUIPMENT: FGD SYSTEM, GENERAL
          END DATE      6/77      PROBLEM: NOT DEFINED/SPECIFIED
                        ONE FORCED OUTAGE WAS DUE TO A BREAKER TRIP RESULTING IN LOSS OF CONTROL
                        POWER.
          AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE    6/77      EQUIPMENT: SPRAY NOZZLES
          END DATE      6/77      PROBLEM: CHEMICAL-RELATED PLUGGING
                        ONE FORCED OUTAGE WAS DUE TO PLUGGING OF THE SPRAY NOZZLES IN THE VENTURI.
          AFFECTED MODULES: SYSTEM

 7/77  SYSTEM       40.0         41.0         40.0         40.0                       744   733    298

      ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE    7/77      EQUIPMENT:
          END DATE      7/77      PROBLEM: DESIGN-RELATED PRESSURE SURGES
                        SEVEN FORCED FGD OUTAGES WERE DUE TO A HIGH/LOW TRIP IN THE SCRUBBER DUCT
                        DURING JULY.
          AFFECTED MODULES: SYSTEM
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-----------------------------------------PERFORMANCE DATA-----------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                               SO2  PART.  HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    7/77      EQUIPMENT: SPRAY NOZZLES
            END DATE      7/77      PROBLEM: CHEMICAL-RELATED PLUGGING
                          ONE TWO HOUR OUTAGE WAS REQUIRED TO CORRECT A PLUGGING PROBLEM IN THE
                          VENTURI SPRAY NOZZLES DURING JULY.
            AFFECTED MODULES: SYSTEM

 8/77  SYSTEM      87.0         91.0         87.0         79.0                       744   629    590

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    8/77      EQUIPMENT: SCRUBBER
            END DATE      8/77      PROBLEM: NOT DEFINED/SPECIFIED
                          A LEAK IN THE VENTURI RECYCLE HEADER RESULTED IN AN FGD OUTAGE.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    8/77      EQUIPMENT: DUCTWORK
            END DATE      8/77      PROBLEM: DESIGN-RELATED PRESSURE SURGES
                          A SCRUBBER DUCT HIGH/LOW BOILER TRIP PROBLEM RESULTED IN OUTAGE TIME.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    8/77      EQUIPMENT: BOILER-RELATED
            END DATE      8/77      PROBLEM: NOT DEFINED/SPECIFIED
                          THERE WAS ONE BOILER RELATED OUTAGE DURING AUGUST.
            AFFECTED MODULES: SYSTEM

 9/77  SYSTEM      74.0         67.0         71.0         64.0                       720   716    462

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    9/77      EQUIPMENT: SCRUBBER
            END DATE      9/77      PROBLEM: NOT DEFINED/SPECIFIED
                          A LEAK IN THE VENTURI RECYCLE LINES RESULTED IN FORCED FGD OUTAGE TIME.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    9/77      EQUIPMENT: PUMP, OTHER
            END DATE      9/77      PROBLEM: NOT DEFINED/SPECIFIED
                          TRAY RECYCLE PUMP REPAIR NECESSITATED FGD OUTAGE TIME.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    9/77      EQUIPMENT: INSTRUMENTATION
            END DATE      9/77      PROBLEM: CHEMICAL-RELATED PLUGGING
                          DUCT PRESSURE HIGH/LOW SENSING LINE PLUGGING RESULTED IN FORCED FGD OUTAGE
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    9/77      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE      9/77      PROBLEM: NOT DEFINED/SPECIFIED
                          AN OUTAGE OCCURRED WHEN THE ASH SLUICE SYSTEM WENT OUT OF SERVICE (NO
                          EMERGENCY SPRAYS) DURING SEPTEMBER.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    9/77      EQUIPMENT: ABSORBER
            END DATE      9/77      PROBLEM: CHEMICAL-RELATED PLUGGING
                          AN OUTAGE OCCURRED WHEN A TRAY PLUGGED.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    9/77      EQUIPMENT: TANK, OTHER
            END DATE      9/77      PROBLEM: NOT DEFINED/SPECIFIED
                          AN OUTAGE OCCURRED TO ALLOW CLEANING OF A SUCTION SCREEN IN THE TRAY
                          RECYCLE TANK.
            AFFECTED MODULES: SYSTEM
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------------------------------------------PERFORMANCE DATA------------------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------

10/77  SYSTEM     76.0         80.0        76.0        80.0                744   704    562

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/77     EQUIPMENT: TANK, OTHER
            END DATE    10/77     PROBLEM: NOT DEFINED/SPECIFIED
                        FGD OUTAGE TIME WAS NEEDED TO CLEAN A PLUGGED TRAY RECYCLE TANK SCREEN.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/77     EQUIPMENT: TANK, OTHER
            END DATE    10/77     PROBLEM: NOT DEFINED/SPECIFIED
                        FGD OUTAGE TIME WAS REQUIRED TO CLEAN A VENTURI TANK SEPARATOR.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/77     EQUIPMENT: PROCESS CONTROL
            END DATE    10/77     PROBLEM: NOT DEFINED/SPECIFIED
                        A HIGH SOLIDS PROBLEM IN THE VENTURI RECYCLE SYSTEM HAD TO BE CORRECTED.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/77     EQUIPMENT: DUCTWORK
            END DATE    10/77
                        A SCRUBBER DUCT HIGH/LOW PRESSURE BOILER TRIP WAS REPAIRED.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/77     EQUIPMENT: FAN
            END DATE    10/77     PROBLEM: DESIGN-RELATED INFERIOR CONSTRUCTION MATERIAL
                        I.D. FAN LEAKS WERE PATCHED.
            AFFECTED MODULES: SYSTEM

11/77  SYSTEM     86.0                                                     720   980      0

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/77     EQUIPMENT: BOILER-RELATED
            END DATE    11/77     PROBLEM: NOT DEFINED/SPECIFIED
                        THE BOILER WAS OUT OF SERVICE FROM OCTOBER 31 UNTIL NOVEMBER 26.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/77     EQUIPMENT: FAN
            END DATE    11/77     PROBLEM: NOT DEFINED/SPECIFIED
                        THE SCRUBBER WAS OUT OF SERVICE FOR AN I.D. FAN ROTOR REPAIR.
            AFFECTED MODULES: SYSTEM

12/77  SYSTEM                                                              744   742      0

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/77     EQUIPMENT: FAN
            END DATE    12/77     PROBLEM: NOT DEFINED/SPECIFIED
                        THE SCRUBBER MODULE WAS OUT OF SERVICE TO INSTALL NEW WEAR PLATES ON AN
                        I.D. FAN ROTOR.
            AFFECTED MODULES: SYSTEM

 1/78  SYSTEM     67.0         74.0        67.0        67.0                744   675    499

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/78     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     1/78     COMMENTS:
                        THE SCRUBBER WENT BACK ON LINE ON JANUARY 4 AFTER THE INSTALLATION OF
                        WEAR PLATES ON AN I.D. FAN ROTOR.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/78     EQUIPMENT: PUMP, OTHER
            END DATE     1/78     PROBLEM: NOT DEFINED/SPECIFIED
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-------------------------------------------PERFORMANCE DATA---------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                     REPAIRS ON THE THICKENER OVERFLOW PUMP CONTRIBUTED TO FGD OUTAGE TIME.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    1/78      EQUIPMENT: SCRUBBER
            END DATE      1/78      PROBLEM: NOT DEFINED/SPECIFIED
                     SOME BUILD UP IN THE VENTURI CONTRIBUTED TO FGD OUTAGE TIME DURING
                     JANUARY.
            AFFECTED MODULES: SYSTEM

 2/78  SYSTEM      93.0        92.0        92.0        87.0                     672   636   585

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    2/78      EQUIPMENT: INSTRUMENTATION
            END DATE      2/78      PROBLEM: CHEMICAL-RELATED PLUGGING
                     A DUCT HIGH/LOW PRESSURE TRIP CONTRIBUTED TO OUTAGE TIME.
            AFFECTED MODULES: SYSTEM SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    2/78      EQUIPMENT: BOILER-RELATED
            END DATE      2/78      PROBLEM: NOT DEFINED/SPECIFIED
                     THE BOILER WAS OUT OF SERVICE FOR 34 HOURS DURING FEBRUARY.
            AFFECTED MODULES: SYSTEM

 3/78  SYSTEM      98.0        89.0        97.0        80.0                     744   672   595

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    3/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE      3/78      PROBLEM: NOT DEFINED/SPECIFIED
                     THERE WAS ONLY ONE FORCED FGD OUTAGE DURING MARCH WHICH LASTED APPROXIMATE
                     LY 18 HOURS.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    3/78      EQUIPMENT: BOILER-RELATED
            END DATE      3/78      COMMENTS:
                     A SCHDULED BOILER OUTAGE AT THE BEGINNING OF MARCH TO REMOVE ASH BUILDUP
                     WAS CANCELLED.
            AFFECTED MODULES: SYSTEM

 4/78  SYSTEM     100.0        98.0       100.0        44.0                     720   320   317

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    4/78      EQUIPMENT: BOILER-RELATED
            END DATE      4/78      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                     THERE WAS ONE SCHEDULED BOILER OUTAGE WHICH LASTED ABOUT 403 HOURS.
            AFFECTED MODULES: SYSTEM

 5/78  SYSTEM     100.0       100.0       100.0        97.0                     744   726   724

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    5/78      EQUIPMENT: BOILER-RELATED
            END DATE      5/78      PROBLEM: NOT DEFINED/SPECIFIED
                     THE BOILER WAS OFF FOR APPPROXIMATELY 18 HOURS FOR REPAIRS ON THE MILL
                     SPOKES.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    5/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE      5/78      PROBLEM: NOT DEFINED/SPECIFIED
                     THE 2A SEC. BREAKER TRIPPED AND CAUSED AN OUTAGE OF ABOUT ONE HOUR.
            AFFECTED MODULES: SYSTEM

 6/78  SYSTEM     100.0        92.0       100.0        92.0                     720   720   661

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    6/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE      6/78      PROBLEM: NOT DEFINED/SPECIFIED
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---------------------------------------------PERFORMANCE DATA-----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                           THERE WERE TWO SCHEDULED FGD OUTAGES TO UNPLUG THE TRAYS AND TO CHANGE
                           THE OIL ON THE I.D. FAN.
                  AFFECTED MODULES: SYSTEM

              ** PROBLEMS/SOLUTIONS/COMMENTS
                  START DATE   6/78      EQUIPMENT: DUCTWORK
                  END DATE     6/78      PROBLEM: DESIGN-RELATED PRESSURE SURGES
                           A FORCED FGD OUTAGE OCCURRED WHEN HIGH DUCT PRESSURE CAUSED A BOILER TRIP.
                  AFFECTED MODULES: SYSTEM

  7/78  SYSTEM       80.0         82.0         79.0        74.0                   744   676    553

              ** PROBLEMS/SOLUTIONS/COMMENTS
                  START DATE   7/78      EQUIPMENT: BOILER-RELATED
                  END DATE     7/78      PROBLEM: NOT DEFINED/SPECIFIED
                           THE BOILER WAS OUT OF SERVICE DUE TO A BOILER TUBE LEAK.
                  AFFECTED MODULES: SYSTEM

              ** PROBLEMS/SOLUTIONS/COMMENTS
                  START DATE   7/78      EQUIPMENT: DUCTWORK
                  END DATE     7/78      PROBLEM: DESIGN-RELATED PRESSURE SURGES
                           HIGH DUCT PRESSURE WAS THE CAUSE OF A BOILER TRIP.  THE HIGH DUCT PRESSURE
                           WAS CAUSED BY A FAULTY POSITIONER ON THE I.D. FAN CONTROLLER.
                  AFFECTED MODULES: SYSTEM

              ** PROBLEMS/SOLUTIONS/COMMENTS
                  START DATE   7/78      EQUIPMENT: EXPANSION JOINT
                  END DATE     7/78      PROBLEM: DESIGN-RELATED INFERIOR CONSTRUCTION MATERIAL
                           THE I.D. FAN EXPANSION JOINT ON THE SCRUBBER WAS REPLACED.
                  AFFECTED MODULES: SYSTEM

              ** PROBLEMS/SOLUTIONS/COMMENTS
                  START DATE   7/78      EQUIPMENT: FAN
                  END DATE     7/78      PROBLEM: NOT DEFINED/SPECIFIED
                           AN FGD OUTAGE OCCURRED WHEN A BOLT, WHICH FELL FROM THE FAN, CAUSED
                           VIBRATIONS.
                  AFFECTED MODULES: SYSTEM

              ** PROBLEMS/SOLUTIONS/COMMENTS
                  START DATE   7/78      EQUIPMENT: BOILER-RELATED
                  END DATE     7/78      PROBLEM: NOT DEFINED/SPECIFIED
                           A SECOND BOILER TRIP DURING JULY WAS CAUSED BY AN UNDETERMINED SOURCE.
                  AFFECTED MODULES: SYSTEM

              ** PROBLEMS/SOLUTIONS/COMMENTS
                  START DATE   7/78      EQUIPMENT: PIPING
                  END DATE     7/78      PROBLEM: CHEMICAL-RELATED PLUGGING
                           THE SUCTION LINE FROM THE VENTURI DISCHARGE LINE TO THE EFFLUENT PUMPS
                           WAS CLEANED OUT DUE TO PLUGGING.
                  AFFECTED MODULES: SYSTEM

  8/78  SYSTEM       81.0         82.0         93.0        81.0                   744   733    601

              ** PROBLEMS/SOLUTIONS/COMMENTS
                  START DATE   8/78      EQUIPMENT: ABSORBER
                  END DATE     8/78      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                           TWO SCHEDULED OUTAGES DURING AUGUST WERE NECESSARY TO CLEAN THE SCRUBBER
                           TRAY.
                  AFFECTED MODULES: SYSTEM

              ** PROBLEMS/SOLUTIONS/COMMENTS
                  START DATE   8/78      EQUIPMENT: SPRAY NOZZLES
                  END DATE     8/78      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                           A SCHEDULED OUTAGE WAS NECESSARY TO CLEAN THE NOZZLES ON THE SCRUBBER SPRA
                           RACK.  THE STAINLESS STEEL PIPE TO THE TRAY SPRAY NOZZLES WAS ALSO
                           REPLACED.
                  AFFECTED MODULES: SYSTEM
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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------------------------------------------PERFORMANCE DATA-------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL    PER  BOILER  FGD   CAP.
                                                                 SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/78     EQUIPMENT: DUCTWORK
            END DATE     8/78     PROBLEM: DESIGN-RELATED PRESSURE SURGES
                         ON AUGUST 1 THE SCRUBBER EXPERIENCED HIGH DUCT PRESSURE.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/78     EQUIPMENT: PUMP, OTHER
            END DATE     8/78     PROBLEM: NOT DEFINED/SPECIFIED
                         ON AUGUST 3 IT WAS NECESSARY TO TAKE THE SCRUBBER OFF LINE TO REPACK THE
                         VENTURI PUMPS.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/78     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     8/78     PROBLEM: NOT DEFINED/SPECIFIED
                         A THIRD OUTAGE IN AUGUST WAS CAUSED BY A LOSS OF THE ASH PANEL CONTROL
                         POWER.  THIS LEFT THE SCRUBBER WITHOUT EMERGENCY SPRAY.
            AFFECTED MODULES: SYSTEM

  9/78 SYSTEM     100.0        97.0       100.0        94.0                    720   693    675

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/78     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     9/78     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                         A SCHEDULED SCRUBBER OUTAGE TOOK PLACE DURING SEPTEMBER IN ORDER TO CLEAN
                         THE TRAY RECYCLE TANK AS WELL AS THE TRAY AND SOME OF THE LINES.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/78     EQUIPMENT: BOILER-RELATED
            END DATE     9/78     PROBLEM: NOT DEFINED/SPECIFIED
                         THREE BOILER RELATED OUTAGES WERE CAUSED BY PROBLEMS WITH A 10-KW
                         GENERATOR.  CONTROL POWER SURGES WERE BEING CAUSED BY OVERVOLTAGE MOTOR
                         TRIPS.
            AFFECTED MODULES: SYSTEM

 10/78 SYSTEM      96.0        95.0        99.0        92.0                    744   721    685

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/78     EQUIPMENT: INSTRUMENTATION
            END DATE    10/78     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                         DURING OCTOBER THE SCRUBBER INSTRUMENTS WERE WORKED ON DURING A SCHEDULED
                         OUTAGE.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/78     EQUIPMENT: BOILER-RELATED
            END DATE    10/78     PROBLEM: NOT DEFINED/SPECIFIED
                         THE BOILER WAS FORCED OUT OF SERVICE FOR ABOUT 28 HOURS BECAUSE OF BOILER
                         DRUM PROBLEMS.
            AFFECTED MODULES: SYSTEM

 11/78 SYSTEM      98.0        93.0        93.0        36.0                    720   277    258

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/78     EQUIPMENT: DUCTWORK
            END DATE    11/78     PROBLEM: DESIGN-RELATED PRESSURE SURGES
                         A FORCED FGD OUTAGE OCCURRED DUE TO HIGH DUCT PRESSURE.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/78     EQUIPMENT: FAN
            END DATE    11/78     PROBLEM: NOT DEFINED/SPECIFIED
                         WORK WAS DONE ON I.D. FAN CONTROLS DURING NOVEMBER.
            AFFECTED MODULES: SYSTEM
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                                       SECTION 3
                     DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
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-------------------------------------------PERFORMANCE DATA--------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
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       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/78      EQUIPMENT: BOILER-RELATED
            END DATE    11/78      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                           THE UNIT WAS SHUT DOWN NOVEMBER 12 FOR SCHEDULED BOILER MAINTENANCE.  THE
                           UNIT REMAINED OUT OF SERVICE THE REMAINDER OF THE MONTH.
            AFFECTED MODULES: SYSTEM

12/78  SYSTEM       95.9         100.0       100.0         13.3                     744   990    990

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/78      EQUIPMENT: PIPING
            END DATE -  12/78      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                           THE SCRUBBER WAS DOWN TO UNPLUG EFFLUENT LINE.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/78      EQUIPMENT: BOILER-RELATED
            END DATE    12/78      PROBLEM: NOT DEFINED/SPECIFIED
                           WHILE THE SCRUBBER WAS DOWN THE BOILER WAS ALSO DOWN FOR PULVERIZER
                           REPAIRS.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/78      EQUIPMENT: BOILER-RELATED
            END DATE    12/78      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                           THE BOILER WAS OFF UNTIL DECEMBER 26 FOR SCHEDULED MAINTENANCE.
            AFFECTED MODULES: SYSTEM

 1/79  SYSTEM       82.9          81.3        81.3         73.9                     744   676    549

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/79      EQUIPMENT: ABSORBER
            END DATE     1/79      PROBLEM: NOT DEFINED/SPECIFIED
                           THE FGD SYSTEM WAS DOWN TO CLEAN A TRAY SCREEN.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/79      EQUIPMENT: PIPING
            END DATE     1/79      PROBLEM: NOT DEFINED/SPECIFIED
                           THE FGD SYSTEM WAS DOWN TO REPAIR A LEAK IN THE VENTURI RECYCLE LINE.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/79      EQUIPMENT: BOILER-RELATED
            END DATE     1/79      PROBLEM: NOT DEFINED/SPECIFIED
                           THE BOILER WAS DOWN TO REPAIR TUBE LEAKS.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/79      EQUIPMENT: PUMP, OTHER
            END DATE     1/79      PROBLEM: NOT DEFINED/SPECIFIED
                           REPAIRS WERE MADE ON THE TRAY AND SPRAY PUMP SYSTEMS.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/79      EQUIPMENT: RECYCLE PUMP
            END DATE     1/79      PROBLEM: NOT DEFINED/SPECIFIED
                           THE VENTURI RECYCLE PUMP LOST POWER.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/79      EQUIPMENT: PUMP, OTHER
            END DATE     1/79      PROBLEM: NOT DEFINED/SPECIFIED
                           THE SCRUBBER TRAY PUMP MOTOR WENT TO GROUND.  THE 2C LOAD CENTER TRIPPED.
            AFFECTED MODULES: SYSTEM
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------------------------------------------PERFORMANCE DATA-------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
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       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    1/79      EQUIPMENT: DUCTWORK
            END DATE      1/79      PROBLEM: DESIGN-RELATED PRESSURE SURGES
                          THERE WAS SCRUBBER TRIP ON HIGH DUCT PRESSURE.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    1/79      EQUIPMENT: DUCTWORK
            END DATE      1/79      PROBLEM: DESIGN-RELATED PRESSURE SURGES
                          A HIGH DUCT PRESSURE TRIP WAS RESPONSIBLE FOR A SHORT OUTAGE.  THE PRESSUR
                          SENSING LINES WERE CLEANED.
            AFFECTED MODULES: SYSTEM

 2/79  SYSTEM      96.5        93.1        93.2        87.9                    672   634    591

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    2/79      EQUIPMENT: PIPING
            END DATE      2/79      PROBLEM: NOT DEFINED/SPECIFIED
                          THE FGD SYSTEM WAS DOWN TO REPAIR LEAK IN THE VENTURI LINE.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    2/79      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE      2/79      PROBLEM: NOT DEFINED/SPECIFIED
                          THE FGD SYSTEM WAS FORCED OUT OF SERVICE DUE TO A 2B LOAD CENTER POWER
                          LOSS.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    2/79      EQUIPMENT: PIPING
            END DATE      2/79      PROBLEM: NOT DEFINED/SPECIFIED
                          THE SCRUBBER WAS FORCED DOWN DUE TO A BREAK IN THE ASH WATER CIRCULATING
                          WATER LINE RESULTING IN LOSS OF EMERGENCY COOLING WATER.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    2/79      EQUIPMENT: SCRUBBER
            END DATE      2/79      PROBLEM: NOT DEFINED/SPECIFIED
                          THE FGD SYSTEM WAS DOWN BECAUSE OF A LEAK ON THE VENTURI RACE TRACK AND
                          TO CLEAN THE VENTURI RACE TRACK NOZZLES.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    2/79      EQUIPMENT: BOILER-RELATED
            END DATE      2/79      PROBLEM: NOT DEFINED/SPECIFIED
                          THE BOILER WAS DOWN TO REPAIR A TUBE LEAK.
            AFFECTED MODULES: SYSTEM
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                                          SECTION 3
                    DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
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 COMPANY NAME                                    NEVADA POWER
 PLANT NAME                                      REID GARDNER
 UNIT NUMBER                                     3
 CITY                                            MOAPA
 STATE                                           NEVADA
 REGULATORY CLASSIFICATION                       A
 PARTICULATE EMISSION LIMITATION - NG/J            43.         (  .100 LB/MMBTU)
 SO2 EMISSION LIMITATION - NG/J                   516.         ( 1.200 LB/MMBTU)
 NET PLANT GENERATING CAPACITY - MW              *******
 GROSS UNIT GENERATING CAPACITY - MW              125.0
 NET UNIT GENERATING CAPACITY W/FGD - MW          110.0
 NET UNIT GENERATING CAPACITY WO/FGD - MW        *******
 EQUIVALENT SCRUBBED CAPACITY - MW                125.0

 ** BOILER DATA
     SUPPLIER                                    FOSTER WHEELER
     TYPE                                        PULVERIZED, BALANCED DRAFT
     SERVICE LOAD                                BASE
     COMMERCIAL SERVICE DATE                      0/76
     MAXIMUM BOILER FLUE GAS FLOW - CU.M/S        223.21       ( 473000 ACFM)
     FLUE GAS TEMPERATURE - C                     176.7        ( 350 F)
     STACK HEIGHT - M                              61.         ( 200 FT)
     STACK TOP DIAMETER - M                      *******       (***** FT)

 ** FUEL DATA
     FUEL TYPE                                   COAL
     FUEL GRADE                                  ******
     AVERAGE HEAT CONTENT - KJ/KG                 28959.       ( 12450 BTU/LB)
     RANGE HEAT CONTENT - BTU/LB                                ******
     AVERAGE ASH CONTENT - %                         8.00
     RANGE ASH CONTENT - %                       ******
     AVERAGE MOISTURE CONTENT - %                ********
     RANGE MOISTURF CONTENT - %                  ******
     AVERAGE SULFUR CONTENT - %                       .50
     RANGE SULFUR CONTENT - %                    0.5-1.0
     AVERAGE CHLORIDE CONTENT - %                ********
     RANGE CHLORIDE CONTENT - %                  ******
     FUEL FIRING RATE - M T/H                    *******       (*** TPH)
     FUEL FIRING RATE - MW                       *****

 ** MECHANICAL COLLECTOR
     TYPE                                        MILTICLONES
     SUPPLIER                                    RESEARCH COTTRELL
     PARTICULATE DESIGN REMOVAL EFFICIENCY - %      75.0

 ** PARTICULATE SCRUBBER
     NUMBER                                       2
     TYPE                                        VARIABLE THROAT
     SUPPLIER                                    ADL/COMBUSTION EQUIP ASSOCIATES
     LINING MATERIAL                             INCOLOY 825
     TYPE OF NOZZLFS                             TANGENTIAL
     BOILER LOAD/SCRUBBER - %                      50.0
     LIQUID RECIRCULATION RATE - LITER/S          157.5        ( 2500 GPM)
     L/G RATIO - LITER/CU.M                         1.3        (10.0 GAL/1000ACF)
     PRESSURE DROP - KPA                            5.0        (   20 IN-H2O)
     SUPERFICIAL GAS VELOCITY - M/S                50.3        (  165.0 FT/S)

 ** FGD SYSTEM
     SALFABLE PRODUCT/THROWAWAY PRODUCT          THROWAWAY PRODUCT
     GENERAL PROCESS TYPE                        WET SCRUBBING
     PROCESS TYPE                                SODIUM CARBONATE
     SYSTEM SUPPLIER                             ADL/COMBUSTION EQUIP ASSOCIATE
     A-E FIRM                                    BECHTEL
     DEVELOPMENT LEVEL                           FULL-SCALE
     NEW/RETROFIT                                NEW
     PARTICULATE DESIGN REMOVAL EFFICIENCY - %     99.00
     SO2 DESIGN REMOVAL EFFICIENCY - %             85.00
     COMMERCIAL DATE                              7/76
     INITIAL START-UP                             6/76
     CONSTRUCTION INITIATION                      0/74
     CONTRACT AWARDED                             0/73

 ** ABSORBER
     NUMBER                                       1
     TYPE                                        PERFORATED PLATE WASHING TOWER
     INITIAL START UP                             6/76
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        NUMBER OF STAGES                                 1
        DIMENSIONS                                     30 DIA.
        BOILER LOAD/ABSORBER - %                        100.0
        LIQUID RECIRCULATION RATE - LITER/S              38.          (  600 GPM)
        PRESSURE DROP - KPA                                .7         ( 3.0 IN-H2O)
        PARTICULATE OUTLET LOAD - NG/J                 41703.         (97.000 LB/MMBTU)
        SO2 DESIGN REMOVAL EFFICIENCY - %                91.2

    ** FANS
        NUMBER                                          1
        TYPE                                           I.D. BOOSTER FAN
        CONSTRUCTION MATERIALS                         CARBON STEEL

    ** MIST ELIMINATO
        NUMBER                                          1
        TYPE                                           RADIAL VANE
        CONFIGURATION                                  HORIZONTAL
        WASH SYSTEM                                    NONE
        PRESSURE DROP - KPA                                .1         (  .5 IN-H2O)

    ** REHEATER
        TYPE                                           INDIRECT HOT AIR
        HEATING MEDIUM                                 STEAM
        TEMPERATURE BOOST - C                            16.7         (   30 F)
        ENERGY REQUIRED                                4 MW

    ** WATER LOOP
        TYPE                                           OPEN
        FRESH MAKEUP WATER ADDITION - LITERS/S            1.6         (   25 GPM)

    ** DISPOSAL
        NATURE                                         INTERIM
        TYPE                                           LINED ASH POND
        LOCATION                                       ON-SITE
        AREA - ACRES                                      6.0

    ** DISPOSAL
        NATURE                                         FINAL
        TYPE                                           EVAP POND
        LOCATION                                       ON-SITE
        TRANSPORTATION                                 GRAVITY FLOW FROM INTERIM SLUDGE POND
        AREA - ACRES                                     45.0


--------------------------------------------PERFORMANCE DATA--------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
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 7/76  SYSTEM      45.0        46.0        70.0        42.0                  744   692    316

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   7/76      EQUIPMENT: SCRUBBER
             END DATE     7/76      PROBLEM: NOT DEFINED/SPECIFIED
                          A HIGH SOLIDS CONCENTRATION IN THE VENTURI SCRUBBING SOLUTION CYCLE WAS
                          A PROBLEM DURING JULY.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   7/76      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     7/76      PROBLEM: NOT DEFINED/SPECIFIED
                          FOUR OUTAGES WERE REPORTED FOR THE MONTH, THREE OF WHICH WERE FORCED
                          SCRUBBER OUTAGES.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   7/76      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     7/76      COMMENTS:
                          THE UNIT 3 SYSTEM WAS PLACED IN OPERATION ON JULY 12, 1976.  THE SCRUBBING
                          SYSTEM DESIGN WAS BASED ON INFORMATION AND DATA OBTAINED FROM AN 8000-ACFM
                          PILOT PLANT PROGRAM CONDUCTED AT THIS STATION IN 1971 AND 1972.
             AFFECTED MODULES: SYSTEM
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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------------------------------------------PERFORMANCE DATA----------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL  PER  BOILER  FGD   CAP.
                                                                SO2 PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- -----  ----- ------

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   7/76     EQUIPMENT: REAGENT HANDLING
            END DATE     7/76     PROBLEM: NOT DEFINED/SPECIFIED
                         A BUCKET ELEV/TOR MALFUNCTION WAS A PROBLEM DURING JULY.
            AFFECTED MODULES: SYSTEM

 8/76  SYSTEM      56.0        43.0        50.0        43.0                      744   744   323

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/76     EQUIPMENT: REHEATER
            END DATE     8/76     PROBLEM: NOT DEFINED/SPECIFIED
                         REHEATER MOTOR BURNOUT RESULTED IN FGD OUTAGE TIME.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/76     EQUIPMENT: SCRUBBER
            END DATE     8/76     PROBLEM: NOT DEFINED/SPECIFIED
                         DISTRUCTION OF THE VENTURI FLOOR RESULTED IN FGD OUTAGE TIME.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/76     EQUIPMENT: FAN
            END DATE     8/76     PROBLEM: NOT DEFINED/SPECIFIED
                         FORCED SCRUBBER OUTAGE WERE CAUSED BY AN I.D. FAN ELECTRICAL MALFUNCTION
                         AND I.D. FAN INSULATION PROBLEMS.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/76     EQUIPMENT: THICKENER
            END DATE     8/76     PROBLEM: CHEMICAL-RELATED PLUGGING
                         THICKENER TANK PLUGGING RESULTED IN FGD OUTAGE TIME.
            AFFECTED MODULES: SYSTEM

 9/76  SYSTEM      49.0        46.0        46.0        44.0                      720   679   314

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/76     EQUIPMENT: SCRUBBER
            END DATE     9/76     PROBLEM: NOT DEFINED/SPECIFIED
                         A VENTURI VIBRATION TRIP RESULTED IN FGD OUTAGE TIME.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/76     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     9/76     COMMENTS:
                         THE SYSTEM WAS PLACED BACK IN SERVICE ON SEPTEMBER IN FOLLOWING EXTENSIVE
                         REPAIRS AND MODIFICATIONS FROM THE PRECEEDING MONTH.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/76     EQUIPMENT: REAGENT HANDLING
            END DATE     9/76     PROBLEM: NOT DEFINED/SPECIFIED
                         TWO REHEATER FAN TRIPS RESULTED IN FGD OUTAGE TIME.
            AFFECTED MODULES: SYSTEM

10/76  SYSTEM      22.0        29.0        21.0        21.0                      744   548   159

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/76     EQUIPMENT: PROCESS CONTROL
            END DATE    10/76     PROBLEM: NOT DEFINED/SPECIFIED
                         HIGH SOLIDS CONTENT IN THE VENTURI RECYCLE SOLUTION RESULTED IN OUTAGE
                         TIME.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/76     EQUIPMENT:
            END DATE    10/76     PROBLEM: COMPONENT FAILURE, OTHER
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-----------------------------------------PERFORMANCE DATA-------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                    A SCRUBBER GAS DAMPER MALFUNCTION RESULTED IN FGD OUTAGE TIME.
          AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  10/76     EQUIPMENT: SCRUBBER
          END DATE    10/76     PROBLEM: NOT DEFINED/SPECIFIED
                    VENTURI BOX PROBLEMS RESULTED N FGD OUTAGE TIME.
          AFFECTED MODULES: SYSTEM

11/76  SYSTEM      28.0         80.0         29.0         29.0                         720   264    212

       ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  11/76     EQUIPMENT: SCRUBBER
          END DATE    11/76     PROBLEM: NOT DEFINED/SPECIFIED
                    THE SCRUBBER SYSTEM WAS NOT IN OPERATION THE FIRST HALF OF NOVEMBER DUE TO
                    REPAIRS OF LEAKS IN THE VENTURI SCRUBBER BOX.  THE SYSTEM WAS RESTARTED
                    NOVEMBER 19.
          AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  11/76     EQUIPMENT: REAGENT HANDLING
          END DATE    11/76     PROBLEM: NOT DEFINED/SPECIFIED
                    A SCREW CONVEYOR MALFUNCTION (PREVENTING CHEMICAL MIXING) RESULTED IN FGD
                    OUTAGE TIME.
          AFFECTED MODULES: SYSTEM

12/76  SYSTEM      99.0         97.0         99.0         97.0                         744   744    721

       ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  12/76     EQUIPMENT: EXPANSION JOINT
          END DATE    12/76     PROBLEM: NOT DEFINED/SPECIFIED
                    ONE MINOR SCRUBBER OUTAGE OCCURRED BECAUSE OF REPAIRS TO THE I.D. FAN
                    EXPANSION JOINT.
          AFFECTED MODULES: SYSTEM

 1/77  SYSTEM      98.0         92.0         98.0         91.0                         744   690    676

       ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE   1/77     EQUIPMENT: ABSORBER
          END DATE     1/77     PROBLEM: CHEMICAL-RELATED PLUGGING
                    A PLUGGED TRAY RESULTED IN FGD OUTAGE TIME.
          AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE   1/77     EQUIPMENT: REHEATER
          END DATE     1/77     PROBLEM: NOT DEFINED/SPECIFIED
                    A REHEATER STEAM LEAK RESULTED IN A MINOR FORCED OUTAGE.
          AFFECTED MODULES: SYSTEM

 2/77  SYSTEM      81.0         74.0         72.0         63.0                         672   575    422

       ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE   2/77     EQUIPMENT: ABSORBER
          END DATE     2/77     PROBLEM: NOT DEFINED/SPECIFIED
                    THREE FORCED SCRUBBER OUTAGES WERE CAUSED BY PROBLEMS WITH THE UPPER TRAY.
          AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE   2/77     EQUIPMENT: PIPING
          END DATE     2/77     PROBLEM: NOT DEFINED/SPECIFIED
                    AN OUTAGE RESULTED FOR CLEANING OUT THE SODIUM CARBONATE LINE.
          AFFECTED MODULES: SYSTEM

 3/77  SYSTEM      44.0         51.0         52.0         44.0                         744   639    324

       ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE   3/77     EQUIPMENT: FGD SYSTEM, GENERAL
          END DATE     3/77     PROBLEM: INSTALLATION-RELATED MATERIALS FAILURE
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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----------------------------------------PERFORMANCE DATA-------------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------
                     THE RUBBER LINING IN THE SEPARATOR REQUIRED DOWNTIME FOR CURING.
           AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    3/77      EQUIPMENT: EXPANSION JOINT
           END DATE      3/77
                     THE SCRUBBER FAN EXPANSION JOINT BLEW OUT CAUSING OUTAGE TIME.
           AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    3/77      EQUIPMENT: ABSORBER
           END DATE      3/77      PROBLEM: CHEMICAL-RELATED PLUGGING
                     MINOR OUTAGES WERE CAUSED BY A PLUGGED TRAY.
           AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    3/77      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE      3/77      PROBLEM: NOT DEFINED/SPECIFIED
                     A MINOR OUTAGE WAS CAUSED BY THE D35 LIMIT SWITCH TRIPPING.
           AFFECTED MODULES: SYSTEM

 4/77  SYSTEM      86.0        85.0        85.0        83.0                      720   709    600

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    4/77      EQUIPMENT: ABSORBER
           END DATE      4/77
                     A HIGH TRAY DIFFERENTAL RESULTED IN FGD OUTAGE TIME.
           AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    4/77      EQUIPMENT: TANK, OTHER
           END DATE      4/77      PROBLEM: CHEMICAL-RELATED PLUGGING
                     A PLUGGED STRAINER IN THE TRAY RECYCLE TANK RESULTED IN A FORCED OUTAGE.
           AFFECTED MODULES: SYSTEM

 5/77  SYSTEM      63.0        26.0        21.0        16.0                      744   470    124

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    5/77      EQUIPMENT: ABSORBER
           END DATE      5/77      PROBLEM: MATERIALS FAILURE,OTHER
                     THE MODULE WAS UNAVAILABLE DURING THE FIRST THREE WEEKS OF THE MONTH
                     BECAUSE OF A FORCED OUTAGE REQUIRED FOR THE REPLACEMENT OF THE FRP LINER
                     IN THE MODULE'S SEPARATOR SECTION.
           AFFECTED MODULES: SYSTEM

 6/77  SYSTEM      98.0        63.0        64.0        62.0                      720   705    443

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    6/77      EQUIPMENT: ABSORBER
           END DATE      6/77      PROBLEM: MATERIALS FAILURE,OTHER
                     A HIGH TRAY DIFFERENTIAL PRESSURE READING WAS A PROBLEM.
           AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    6/77      EQUIPMENT: VALVES
           END DATE      6/77      PROBLEM: NOT DEFINED/SPECIFIED
                     A VENTURI RECYCLE LINE THROTTLE VALVE WAS A PROBLEM.
           AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    6/77      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE      6/77      PROBLEM: NOT DEFINED/SPECIFIED
                     FOUR SCRUBBER OUTAGES WERE REPORTED, THREE OF WHICH WERE FORCED.
           AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    7/77      EQUIPMENT: ABSORBER
           END DATE      7/77      PROBLEM: NOT DEFINED/SPECIFIED
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-------------------------------------------PERFORMANCE DATA-------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ----- ----- ------
                       A HIGH TRAY DIFFERENTIAL PRESSURE READING CONTRIBUTED TO FORCED SCRUBBER
                       OUTAGES.
             AFFECTED MODULES: SYSTEM

 7/77  SYSTEM      73.0         73.0         73.0         73.0                     744   744    542

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    7/77      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE      7/77      COMMENTS:
                       FIVE FORCED SCRUBBER OUTAGES WERE ENCOUNTERED DURING JULY.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    7/77      EQUIPMENT: VALVES
             END DATE      7/77      PROBLEM: NOT DEFINED/SPECIFIED
                       REPAIRS TO THE VENTURI DISCHARGE VALUE CONTRIBUTED TO FGD OUTAGE TIME.
             AFFECTED MODULES: SYSTEM

 8/77  SYSTEM      70.0         63.0         63.0         50.0                     744   629    375

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    8/77      EQUIPMENT: PIPING
             END DATE      8/77      PROBLEM: NOT DEFINED/SPECIFIED
                       DUE TO A LEAK IN VENTURI RECYCLE LINE THE UNIT WAS OFF LINE PART OF THE
                       MONTH.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    7/77      EQUIPMENT: FAN
             END DATE      7/77      PROBLEM: DESIGN-RELATED VIBRATION
                       SCRUBBER FAN VIBRATION PROBLEMS CONTRIBUTED TO FORCED SCRUBBER OUTAGES.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    8/77      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE      8/77      PROBLEM: NOT DEFINED/SPECIFIED
                       A FALSE ALARM DUE TO SCRUBBER OUTLET TEMPERATURE CAUSED SHUTDOWN FOR ABOUT
                       A DAY.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    8/77      EQUIPMENT: BOILER-RELATED
             END DATE      8/77      PROBLEM: NOT DEFINED/SPECIFIED
                       THE BOILER WAS OUT OF SERVICE FOR ABOUT A WEEK DURING AUGUST.
             AFFECTED MODULES: SYSTEM

 9/77  SYSTEM      90.0         90.0         99.0         90.0                     720   720    646

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    9/77      EQUIPMENT: PROCESS CONTROL
             END DATE      9/77      PROBLEM: NOT DEFINED/SPECIFIED
                       HIGH SOLIDS IN THE VENTURI RECYCLE SYSTEM CAUSED SOME OUTAGE TIME IN
                       SEPTEMBER.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    9/77      EQUIPMENT: PIPING
             END DATE      9/77      PROBLEM: NOT DEFINED/SPECIFIED
                       NEW EFFLUENT AND POST NEUTRALIZATION LINES WERE INSTALLED.
             AFFECTED MODULES: SYSTEM

10/77  SYSTEM      99.0         90.0         99.0         61.0                     744   506    455

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   10/77      EQUIPMENT: BOILER-RELATED
             END DATE     10/77      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                       THE SCRUBBER WAS DOWN 284.42 HOURS DURING OCTOBER FOR A SCHEDULED BOILER
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------------------------------------------PERFORMANCE DATA-----------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- -----  ----- ------
                         OUTAGE.
              AFFECTED MODULES: SYSTEM

         ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  10/77      EQUIPMENT: FAN
              END DATE    10/77      PROBLEM: DESIGN-RELATED VIBRATION
                          4.45 HOURS OUTAGE TIME OCCURRED AS A RESULT OF HIGH VIBRATION PROBLEMS ON
                          A SCRUBBER FAN.
              AFFECTED MODULES: SYSTEM

11/77  SYSTEM       89.0        88.0        89.0        87.0                     720   709    624

         ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  11/77      EQUIPMENT: VALVES
              END DATE    11/77      PROBLEM: NOT DEFINED/SPECIFIED
                          THE SCRUBBER WAS DOWN ROUGHLY 80 HOURS FOR THE INSTALLATION OF AN OUTLET
                          NOZZLE IN THE BOOSTER TANK.
              AFFECTED MODULES: SYSTEM

         ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  11/77      EQUIPMENT: BOILER-RELATED
              END DATE    11/77      PROBLEM: NOT DEFINED/SPECIFIED
                          THE BOILER WAS OUT OF SERVICE APPROXIMATELY 15 HOURS IN NOVEMBER.
              AFFECTED MODULES: SYSTEM

12/77  SYSTEM       88.0        92.0        96.0        93.0                     744   692    635

         ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  12/77      EQUIPMENT: INSTRUMENTATION
              END DATE    12/77      PROBLEM: NOT DEFINED/SPECIFIED
                          A FAULTY THERMOCOUPLE CAUSED "SEPARATOR HIGH TEMPERATURE" WHICH IN TURN
                          CONTRIBUTED TO FGD OUTAGE TIME.
              AFFECTED MODULES: SYSTEM

         ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  12/77      EQUIPMENT: BOILER-RELATED
              END DATE    12/77      PROBLEM: NOT DEFINED/SPECIFIED
                          BOILER OUTAGE TIME AMOUNTED TO 51 HOURS IN DECEMBER.
              AFFECTED MODULES: SYSTEM

         ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  12/77      EQUIPMENT: SPRAY NOZZLES
              END DATE    12/77      PROBLEM: NOT DEFINED/SPECIFIED
                          THE INSTALLATION OF TRAY SPRAY STRAINER CONTRIBUTED TO FGD OUTAGE TIME.
              AFFECTED MODULES: SYSTEM

         ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  12/77      EQUIPMENT: INSTRUMENTATION
              END DATE    12/77      PROBLEM: NOT DEFINED/SPECIFIED
                          INSTALLATION OF NEW SENSING LINES CONTRIBUTED TO FGD OUTAGE TIME.
              AFFECTED MODULES: SYSTEM

1/78   SYSTEM      100.0       100.0       100.0       100.0                     744   744    740

         ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  1/78       EQUIPMENT:
              END DATE    1/78       PROBLEM: CHEMICAL-RELATED PLUGGING
                          A PLUGGED VENTURI NOZZLE CAUSED THE ONLY FGD OUTAGE DURING JANUARY.
              AFFECTED MODULES: SYSTEM

         ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  1/78       EQUIPMENT: BOILER-RELATED
              END DATE    1/78       COMMENTS:
                          THE BOILER OPERATED THE ENTIRE MONTH WITH NO OPERATIONAL PROBLEMS.
              AFFECTED MODULES: SYSTEM

2/78   SYSTEM       96.0        95.0        95.0        88.0                     672   619    588
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------------------------------------------PERFORMANCE DATA------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    2/78      EQUIPMENT: SCRUBBER
           END DATE      2/78      PROBLEM: NOT DEFINED/SPECIFIED
                         AN FGD SYSTEM OUTAGE DUE TO A HIGH VENTURI TEMPERATURE (CAUSED BY FAULTY
                         WIRING) OCCURRED DURING FEBRUARY.
           AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    2/78      EQUIPMENT: INSTRUMENTATION
           END DATE      2/78      PROBLEM: NOT DEFINED/SPECIFIED
                         A MINOR OUTAGE WAS NECESSARY TO CHECK THE VENTURI TEMPERATURE INDICATOR.
           AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    2/78      EQUIPMENT: TANK, OTHER
           END DATE      2/78      PROBLEM: CHEMICAL-RELATED PLUGGING
                         AN FGD OUTAGE WAS CAUSED BY PLUGGING OF THE MIX TANK WHICH MADE IT IMPOS-
                         SIBLE TO MIX CHEMICALS.
           AFFECTED MODULES: SYSTEM

 3/78  SYSTEM     97.0        97.0        97.0        96.0                     744   741   718

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    3/78      EQUIPMENT: TANK, OTHER
           END DATE      3/78      PROBLEM: CHEMICAL-RELATED PLUGGING
                         THE MIX TANK PROBLEM CONTINUED INTO MARCH CAUSING THE ONLY FGD DOWNTIME
                         FOR THE MONTH.
           AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    3/78      EQUIPMENT: BOILER-RELATED
           END DATE      3/78      PROBLEM: NOT DEFINED/SPECIFIED
                         A FURNACE HIGH/LOW PRESSURE TRIP CAUSED A BOILER OUTAGE OF 6 HOURS.
           AFFECTED MODULES: SYSTEM

 4/78  SYSTEM     97.0        89.0        97.0        87.0                     720   704   629

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    4/78      EQUIPMENT: SPRAY NOZZLES
           END DATE      4/78      PROBLEM: NOT DEFINED/SPECIFIED
                         THE FGD SYSTEM WAS DOWN FOR REPAIRS ON THE VENTURI EMERGENCY SPRAY SYSTEM.
           AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    4/78      EQUIPMENT: BOILER-RELATED
           END DATE      4/78      PROBLEM: NOT DEFINED/SPECIFIED
                         THE BOILER WAS DOWN APPROXIMATELY 70 HOURS DURING APRIL.
           AFFECTED MODULES: SYSTEM

 5/78  SYSTEM     97.0        77.0        96.0        66.0                     744   646   494

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    5/78      EQUIPMENT: BOILER-RELATED
           END DATE      5/78      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                         THERE WAS A SCHEDULED OUTAGE OF 230 HOURS FOR BOILER MAINTENANCE DURING
                         MAY.
           AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    5/78      EQUIPMENT: INSTRUMENTATION
           END DATE      5/78      PROBLEM: NOT DEFINED/SPECIFIED
                         AN FGD FORCED OUTAGE RESULTED FROM A FAULTY TEMPERATURE PROBE AT THE
                         VENTURI DURING MAY.
           AFFECTED MODULES: SYSTEM

 6/78  SYSTEM    100.0        96.0        96.0        95.0                     720   715   686
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----------------------------------------------PERFORMANCE DATA--------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ---- ----- ----- ----- ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   6/78     EQUIPMENT: BOILER-RELATED
              END DATE     6/78     PROBLEM: NOT DEFINED/SPECIFIED
                           A HIGH/LOW FURNACE PRESSURE TRIP RESULTED IN BOILE DOWNTIME.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   6/78     EQUIPMENT: AUXILIARY EQUIPMENT
              END DATE     6/78     PROBLEM: NOT DEFINED/SPECIFIED
                           A SCHEDULED FGD OUTAGE OCCURRED WHEN THE FIRE SPRAY SYSTEM WAS OUT OF
                           SERVICE.
              AFFECTED MODULES: SYSTEM

 7/78  SYSTEM     100.0        60.0        100.0        78.0                   744   726   583

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   7/78     EQUIPMENT: SCRUBBER
              END DATE     7/78     PROBLEM: NOT DEFINED/SPECIFIED
                           LOW VENTURI FLOW CAUSED AN FGD OUTAGE.  THIS WAS CORRECTED WHEN THE RACE
                           TRACK WERE CLEANED.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   7/78     EQUIPMENT: BOILER-RELATED
              END DATE     7/78     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                           A SCHEDULED OUTAGE TO CLEAN THE TURBINE LUBE OIL COOLERS OCCURRED DURING
                           JULY.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   7/78     EQUIPMENT: TANK, OTHER
              END DATE     7/78     PROBLEM: NOT DEFINED/SPECIFIED
                           AN OUTAGE WAS REQUIRED FOR INSPECTION OF THE VENTURI TANK AND RACE TRACK.
                           DURING THE OUTAGE THE TANK AND RACE TRACK NOZZLES WERE CLENED AND THE
                           RUBBER LINING ON THE VENTURI SPOOL WAS REPLACED.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   7/78     EQUIPMENT: SCRUBBER
              END DATE     7/78     PROBLEM: NOT DEFINED/SPECIFIED
                           AN OUTAGE WAS REQUIRED TO CLEAN THE VENTURIRACE TRACK.
              AFFECTED MODULES: SYSTEM

 8/78  SYSTEM      98.0        98.0         98.0        97.0                   744   736   721

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   8/78     EQUIPMENT: BOILER-RELATED
              END DATE     8/78     PROBLEM: NOT DEFINED/SPECIFIED
                           ONE FORCED BOILER OUTAGE OCCURRED DUE TO HIGH FURNACE PRESSURE.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   8/78     EQUIPMENT: FAN
              END DATE     8/78     PROBLEM: DESIGN-RELATED PRESSURE SURGES
                           THE SCRUBBER WAS FORCED OFF LINE ON AUGUST 28 DUE TO HIGH SCRUBBER FAN
                           OUTLET PRESSURE.  THE SCRUBBER PRESSURE SENSING LINE WAS CLEANED.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   8/78     EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     8/78     PROBLEM: NOT DEFINED/SPECIFIED
                           ON AUGUST 29 THE SCRUBBER EFFLUENT SOLIDS LEVEL WAS HIGH CAUSING AN OUTAGE
                           OF APPROXIMATELY FIVE HOURS.  THE SYSTEM WAS FLUSHED TO CORRECT THE
                           PROBLEM.
              AFFECTED MODULES: SYSTEM

 9/78  SYSTEM     100.0        97.0        100.0        32.0                   720   236   228
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------------------------------------------PERFORMANCE DATA-----------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/78      EQUIPMENT: BOILER-RELATED
            END DATE     9/78      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                         THE UNIT WENT DOWN ON SEPTEMBER 10 FOR A TURBINE OVERHAUL WHICH LASTED
                         THROUGH THE END OF THE MONTH.
            AFFECTED MODULES: SYSTEM

10/78  SYSTEM    100.0                                                      744           0

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/78      EQUIPMENT: BOILER-RELATED
            END DATE    10/78      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                         THE UNIT WAS DOWN THE ENTIRE MONTH OF OCTOBER FOR TURBINE OVERHAUL.
            AFFECTED MODULES: SYSTEM

11/78  SYSTEM     98.0        91.0        91.0        62.0                  720   489    447

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/78      EQUIPMENT: BOILER-RELATED
            END DATE    11/78      COMMENTS:
                         THE UNIT WAS BROUGHT BACK ON LINE THE 10TH OF NOVEMBER.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/78      EQUIPMENT: INSTRUMENTATION
            END DATE    11/78      PROBLEM: NOT DEFINED/SPECIFIED
                         THE FGD SYSTEM WAS DOWN ABOUT 2 HOURS FOR REPAIRING VENTURI TEMPERATURE
                         PROBES.
            AFFECTED MODULES: SYSTEM

12/78  SYSTEM    100.0       100.0       100.0       100.0                  744   744    744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    12/78      COMMENTS:
                         NO FGD OUTAGES WERE REPORTED DURING DECEMBER.
            AFFECTED MODULES: SYSTEM

 1/79  SYSTEM     66.4        67.2        67.2        66.4                  744   735    494

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/79      EQUIPMENT: SCRUBBER
            END DATE     1/79      PROBLEM: NOT DEFINED/SPECIFIED
                         OUTAGE TIME WAS NECESSARY TO REPAIR A HOLE IN THE VENTURI BOX.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/79      EQUIPMENT: PROCESS CONTROL
            END DATE     1/79      PROBLEM: NOT DEFINED/SPECIFIED
                         TWO FORCED OUTAGES OCCURRED BECAUSE EFFLUENT SOLIDS WERE HIGH.  THE SYSTEM
                         WAS CLEANED.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   2/79      EQUIPMENT: FAN
            END DATE     2/79      PROBLEM: COMPONENT FAILURE, OTHER
                         A MAJOR OUTAGE OCCURED WHEN THE SCRUBBER REHEATER FAN MOTOR BURNT OUT.
            AFFECTED MODULES: SYSTEM

 2/79  SYSTEM     40.6        45.7        45.7        40.6                  672   660    302

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   2/79      EQUIPMENT: REHEATER
            END DATE     2/79      PROBLEM: NOT DEFINED/SPECIFIED
                         A STEAM LEAK IN THE SCRUBBER REHEATER COIL RESULTED IN OUTAGE TIME.
            AFFECTED MODULES: SYSTEM
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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---------------------------------------------PERFORMANCE DATA-----------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL    PER  BOILER   FGD   CAP.
                                                                SO2  PART.  HOURS  HOURS  HOURS  FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- -----  ----- -----  -----  ------

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    2/79      EQUIPMENT: SCRUBBER
            END DATE      2/79      PROBLEM: NOT DEFINED/SPECIFIED
                          THE FGD SYSTEM WAS OFF FOR A FEW HOURS TO REPAIR A LEAK IN THE VENTURI
                          LINE.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    2/79      EQUIPMENT: PIPING
            END DATE      2/79      PROBLEM: NOT DEFINED/SPECIFIED
                          THE SCRUBBER WAS DOWN TO REPAIR LEAKS IN EFFLUENT AND VENTURI LINES.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    2/79      EQUIPMENT: BOILER-RELATED
            END DATE      2/79      PROBLEM: DESIGN-RELATED PRESSURE SURGES
                         THE SCRUBBER WAS OFF WITH HIGH FURNACE PRESSURE ON THE BOILER.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    2/79      EQUIPMENT: SCRUBBER
            END DATE      2/79      PROBLEM: NOT DEFINED/SPECIFIED
                          THE RACE TRACK NOZZLES WERE CLEANED.
            AFFECTED MODULES: SYSTEM
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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COMPANY NAME                                    NORTHERN INDIANA PUB SERVICE
PLANT NAME                                      DEAN H. MITCHELL
UNIT NUMBER                                     11
CITY                                            GARY
STATE                                           INDIANA
REGULATORY CLASSIFICATION                       C
PARTICULATE EMISSION LIMITATION - NG/J          ******         (****** LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                  ******         (****** LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW                115.0
GROSS UNIT GENERATING CAPACITY - MW               115.0
NET UNIT GENERATING CAPACITY W/FGD - MW           115.0
NET UNIT GENERATING CAPACITY WO/FGD - MW        *******
EQUIVALENT SCRUBBED CAPACITY - MW                 115.0

** BOILER DATA
    SUPPLIER                                    ******
    TYPE                                        ******
    SERVICE LOAD                                BASE
    COMMERCIAL SERVICE DATE                      5/70
    MAXIMUM BOILER FLUE GAS FLOW - CU.M/S          217.07        ( 460000 ACFM)
    FLUE GAS TEMPERATURE - C                       148.9         ( 300 F)
    STACK HEIGHT - M                            ******           (**** FT)
    STACK TOP DIAMETER - M                      *******          (***** FT)

** FUEL DATA
    FUEL TYPE                                   COAL
    FUEL GRADE                                  ******
    AVERAGE HEAT CONTENT - KJ/KG                 25586.          ( 11000 BTU/LB)
    RANGE HEAT CONTENT - BTU/LB                                    ******
    AVERAGE ASH CONTENT - %                     ********
    RANGE ASH CONTENT - %                       10.
    AVERAGE MOISTURE CONTENT - %                   11.00
    RANGE MOISTURE CONTENT - %                  ******
    AVERAGE SULFUR CONTENT - %                      3.50
    RANGE SULFUR CONTENT - %                    3.2-3.5
    AVERAGE CHLORIDE CONTENT - %                ********
    RANGE CHLORIDE CONTENT - %                  ******
    FUEL FIRING RATE - M T/H                       45.3          ( 50 TPH)
    FUEL FIRING RATE - MW                       *****

** ESP
    NUMBER                                        1

** PARTICULATE SCRUBBER
    NUMBER                                        1
    TYPE                                        VARIABLE THROAT VENTURI
    NUMBER OF STAGES                                1

** FGD SYSTEM
    SALEABLE PRODUCT/THROWAWAY PRODUCT          SALEABLE PRODUCT
    GENERAL PROCESS TYPE                        WET SCRUBBING
    PROCESS TYPE                                WELLMAN LORD
    PROCESS ADDITIVES                           SODIUM SULFITE-BISULFITE
    SYSTEM SUPPLIER                             DAVY POWERGAS
    A-E FIRM                                    DAVY POWERGAS
    CONSTRUCTION FIRM                           DAVY POWERGAS
    DEVELOPMENT LEVEL                           DEMONSTRATION
    NEW/RETROFIT                                RETROFIT
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %     98.50
    SO2 DESIGN REMOVAL EFFICIENCY - %             90.00
    COMMERCIAL DATE                              6/77
    INITIAL START-UP                             7/76
    CONSTRUCTION COMPLETION                     12/75
    CONSTRUCTION INITIATION                      8/74
    CONTRACT AWARDED                             6/72

** ABSORBER
    NUMBER                                        1
    TYPE                                        VALVE TRAY-COLLECTOR TRAY
    INITIAL START UP                             7/76
    NUMBER OF STAGES                                3
    BOILER LOAD/ABSORBER - %                      100.0
    GAS FLOW - CU.M/S                             198.20         ( 420000 ACFM)
    GAS TEMPERATURE - C                           142.2          (  288 F)
    PARTICULATE REMOVAL EFFICIENCY - %             98.0
    SO2 DESIGN REMOVAL EFFICIENCY - %              91.0
```

** CENTRIFUGE	
NUMBER	1
TYPE	SODIUM SULFITE CRYSTAL REMOVAL
** FANS	
NUMBER	1
TYPE	BOOSTER
** FANS	
NUMBER	2
TYPE	BOILER I.D.

** PUMPS

SERVICE	NUMBER
DISSOLVING TANK TO ABSORBER FEED T/N	****
FLYASH PURGE TO POND PUMP	****
RECYCLE	3
EVAPORATOR-CRYSTALLIZER FEED	****
ABSORBER FEED	****

** TANKS

SERVICE	NUMBER
ABSORBER FEED TANK	****
ABSORBER SURGE TANK	****
NACO3 MAKEUP, NA2SO3 DISSOLVING	****

** REHEATER	
TYPE	DIRECT COMBUSTION
TEMPERATURE BOOST - C	27.8 (50 F)
** WATER LOOP	
TYPE	CLOSED
** REAGENT PREPARATION EQUIPMENT	
POINT OF ADDITION	PNEUMATIC CONVEYOR
** BYPRODUCTS	
BYPRODUCT NATURE	ELEMENTAL SULFUR
BYPRODUCT QUALITY - %	99.9

PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
11/76	SYSTEM							720			

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 11/76 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 7/77

FOLLOWING COMPLETION OF CONSTRUCTION IN MID-1976, START-UP OF THE VARIOUS SUBSYSTEMS AND COMPONENT PARTS WAS INITIATED. DURING THE PERIOD JULY THROUGH NOVEMBER, THREE SUSTAINED RUNS OF THE SO2 ABSORBER AND REGENERATIO SYSTEM UNDER NORMAL OPERATING CONDITIONS WERE ACHIEVED. SO2 REMOVAL EFFICIENCY WAS EQUAL TO OR GREATER THAN THE 90% PERFORMANCE CRITERIA. UNIT 11 BOILER OPERATED 121 FULL DAYS AND 10 PARTIAL DAYS. THE WELLMAN-LORD SO2 RECOVERY UNIT OPERATED 71 FULL DAYS AND 23 PARTIAL DAYS. DURING THIS PERIOD, NUMEROUS MODIFICATIONS AND CORRECTIONS TO THE SYSTEM WERE COMPLETED. THESE INCLUDED MODIFYING THE ABSORBER KOCH VALVE TRAYS TO IMPROVE TURNDOWN, RUBBER LINING THE BOTTOM ABSORBER COLLECTOR TRAY, RELOCATING AND IMPROVING TEMPERATURE CONTROL OF THE LOW PRESSURE STEAM SUPPLY, INSTALLING IMPROVED SO2 SAMPLE PROBES AND SEVERAL REPLACEMENTS AND MODIFICATIONS TO THE PURGE SALT RECOVERY AREA. FULLY INTEGRATED OPERATIONS INCLUDING SO2 REDUCTION AND SULFUR RECOVERY OCCURRED IN NOVEMBER, 1976. JANUARY THROUGH MAY 1977 - UNIT 11 BOILER WAS OUT-OF-SERVICE FOR ABOUT FIVE MONTHS FOLLOWING A BOILER-RELATED MISHAP WHICH OCCURRED ON JANUARY 15, 1977, DURING START-UP AFTER A SCHEDULED MAINTENANCE TURN AROUND.

ON JUNE 13, 1977 FGD OPERATIONS RESUMED FOLLOWING RETURN TO FULL SERVICE O

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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-----------------------------------------PERFORMANCE DATA------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL    PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS  HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------
                            UNIT 11 BOILER.  BY JUNE 15 FULLY INTEGRATED OPERATION OF THE ENTIRE FGD
                            PLANT WAS ACHIEVED.  THROUGH JUNE AND JULY, SEVERAL HUNDRED HOURS OF TOTAL
                            SYSTEM OPERATION AT BOTH PARTIAL AND FULL LOAD WERE ACCRUED.
               AFFECTED MODULES: SYSTEM

12/76  SYSTEM                                                                     744

 1/77  SYSTEM                                                                     744

 2/77  SYSTEM                                                                     672

 3/77  SYSTEM                                                                     744

 4/77  SYSTEM                                                                     720

 5/77  SYSTEM                                                                     744

 6/77  SYSTEM                                                                     720

 7/77  SYSTEM                                                                     744

 8/77  SYSTEM                                                                     744

        ** PROBLEMS/SOLUTIONS/COMMENTS
               START DATE   8/77      EQUIPMENT: FGD SYSTEM, GENERAL
               END DATE     9/77      COMMENTS:
                            PERFORMANCE TESTS COMMENCED ON AUGUST 29, 1977 AND WERE SUCCESSFULLY COM-
                            PLETED ON SEPTEMBER 14, 1977.  THE TEST PERIOD INCLUDED 12 DAYS AT 92 MW
                            FLUE GAS EQUIVALENT AND 3.5 DAYS AT 110 MW FLUE GAS EQUIVALENT.  DURING
                            THIS PERIOD, 91% OF THE SO2 WAS REMOVED WHILE BURNING COAL CONTAINING 3%
                            SULFUR AND 204 TONS OF ELEMENTAL SULFUR WERE RECOVER.  ALL PERFORMANCE CRI
                            TERIA WERE MET INCLUDING SO2 REMOVAL, PARTICULATE EMISSION, RAW MATERIAL
                            AND UTILITY CONSUMPTIONS AND RECOVERED SULFUR QUALITY.  THE FGD UNIT SHUT
                            DOWN SEPTEMBER 19 AND REMAINED IDLE THROUGH MONTH END DUE TO COAL FEED
                            PROBLEMS RESULTING FROM WET COAL ON THE UNIT 11 BOILER.
               AFFECTED MODULES: SYSTEM

 9/77  SYSTEM                                                                     720

10/77  SYSTEM                                                                     744

        ** PROBLEMS/SOLUTIONS/COMMENTS
               START DATE  10/77      EQUIPMENT: FGD SYSTEM, GENERAL
               END DATE    10/77      COMMENTS:
                            A DEMONSTRATION PERIOD OF ONE YEAR BEGAN SEPTEMBER 16.  DURING OCTOBER, TH
                            FGD UNIT OPERATED 132 HOURS.  OPERATIONS WERE INTERUPTED WHILE HEAT BAL-
                            ANCE TESTS WERE CONDUCTED ON THE UNIT 11 BOILER BY NIPSCO AND TRW AND WERE
                            INTERRUPTED FURTHER TO MAKE REPAIRS TO THE SO2 REDUCTION SECTION, THE EVAP
                            ORATOR, AND THE UNIT 11 BOILER.
               AFFECTED MODULES: SYSTEM

11/77  SYSTEM       74.0                      72.0        90.0                    720            428

        ** PROBLEMS/SOLUTIONS/COMMENTS
               START DATE  11/77      EQUIPMENT: FGD SYSTEM, GENERAL
               END DATE    11/77      COMMENTS:
                            THE FGD UNIT OPERATED FOR 18 CONSECUTIVE DAYS, AVERAGING 90% SO2 REMOVAL
                            WITH 285 LONG TONS OF SULFUR RECOVERED.  FGD OPERATION WAS INTERRUPTED BY
                            UNIT 11 BOILER TUBE LEAK AND RESUMPTION OF FGD OPERATION WAS FURHTER DELAY
                            ED BY MAINTENANCE IN THE EVAPORATOR SECTION.
               AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
               START DATE  11/77      EQUIPMENT: GAS DAMPER
               END DATE    11/77      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                            MAINTENANCE WAS PERFORMED ON THE FLUE GAS ISOLATION DAMPER.
               AFFECTED MODULES: SYSTEM
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----------------------------------------PERFORMANCE DATA-------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                               SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/77     EQUIPMENT: FAN
            END DATE    11/77     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                         MAINTENANCE WAS PERFORMED ON THE FLUE GAS BOOSTER BLOWER.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/77     EQUIPMENT: AUXILIARY EQUIPMENT
            END DATE    11/77     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                         MAINTENANCE WAS PERFORMED ON THE SO2 REDUCTION SECTION.
            AFFECTED MODULES: SYSTEM

12/77  SYSTEM     49.0                    .0          .0                      768            0

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/77     EQUIPMENT: FAN
            END DATE    12/77     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                         MAINTENANCE WAS PERFORMED ON THE FLUE GAS BOOSTER BLOWER
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/77     EQUIPMENT: AUXILIARY EQUIPMENT
            END DATE    12/77     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                         MAINTENANCE WAS PERFORMED ON THE ABSORBER SOLUTION REGENERATION SECTION.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/77     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    12/77     COMMENTS:
                         THE FGD SYSTEM WAS NOT OPERATED DURING THIS PERIOD DUE TO ABNORMAL BOILER
                         OPERATING CONDITIONS RELATED TO HIGH SILICA LEVELS IN THE FEED WATER.  THE
                         HIGH SILICA LEVELS RESULTED FROM HIGH MAKE-UP WATER REQUIREMENTS DUE IN
                         PART TO A HIGHER THAN NORMAL FGD PLANT USAGE, AS WELL AS UNIT 11 COAL FEED
                         PROBLEM AND A PRECIPITATION MALFUNCTION.
            AFFECTED MODULES: SYSTEM

 1/78  SYSTEM     60.0                    .0          .0                      720            0

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/78     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     1/78     COMMENTS:
                         THE FGD SYSTEM REMAINED DOWN THROUGHOUT JANUARY AS HIGH SILICA LEVELS IN
                         THE UNIT 11 BOILER FEED WATER PERSISTED.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/78     EQUIPMENT: ESP
            END DATE     1/78     PROBLEM: NOT DEFINED/SPECIFIED
                         MAINTENANCE WAS PERFORMED ON THE UNIT 11 PRECIPITATOR.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/78     EQUIPMENT: FAN
            END DATE     1/78     COMMENT: PREVENTIVE MAINTENANCE
                         MAINTENANCE WAS PERFORMED ON THE FLUE GAS BOOSTER BLOWER.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/78     EQUIPMENT: AUXILIARY EQUIPMENT
            END DATE     1/78     COMMENT: PREVENTIVE MAINTENANCE
                         MAINTENANCE WAS PERFORMED ON THE FGD SYSTEM SO2 COMPRESSOR.
            AFFECTED MODULES: SYSTEM

 2/78  SYSTEM     47.0                    .0          .0                      720            0

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   2/78     EQUIPMENT:
            END DATE     2/78     COMMENTS:
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------------------------------------------PERFORMANCE DATA-------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                             THE FGD SYSTEM WAS NOT OPERATED DUE TO ABNORMAL BOILER OPERATING CONDITION
                             RELATED TO HIGH SILICA LEVELS IN THE BOILER FEED WATER, COUPLED WITH UNIT
                             11 COAL FEED PROBLEMS, STOP VALVE PROBLEMS, PRECIPITATOR MALFUNCTION AND A
                             LEAKING BOILER TUBE AND WORK ON THE FLUE GAS ISOLATION DAMPER.
                   AFFECTED MODULES: SYSTEM

              ** PROBLEMS/SOLUTIONS/COMMENTS
                   START DATE   2/78      EQUIPMENT: FAN
                   END DATE     2/78      COMMENT: PREVENTIVE MAINTENANCE
                             MAINTENANCE WAS PERFORMED ON THE FLUE GAS BOOSTER BLOWER.
                   AFFECTED MODULES: SYSTEM

              ** PROBLEMS/SOLUTIONS/COMMENTS
                   START DATE   2/78      EQUIPMENT: GAS DAMPER
                   END DATE     2/78      COMMENT: PREVENTIVE MAINTENANCE
                             MAINTENANCE WAS PERFORMED ON THE FLUE GAS ISOLATION DAMPER.
                   AFFECTED MODULES: SYSTEM

              ** PROBLEMS/SOLUTIONS/COMMENTS
                   START DATE   2/78      EQUIPMENT: RECYCLE PUMP
                   END DATE     2/78      COMMENT: PREVENTIVE MAINTENANCE
                             MAINTENANCE WAS PERFORMED ON THE EVAPORATOR CIRCIRCULATING PUMP.
                   AFFECTED MODULES: SYSTEM

              ** PROBLEMS/SOLUTIONS/COMMENTS
                   START DATE   2/78      EQUIPMENT: PIPING
                   END DATE     2/78      COMMENT: PREVENTIVE MAINTENANCE
                             MAINTENANCE WAS PERFORMED ON THE SO2 SUPERHEATER PIPING.
                   AFFECTED MODULES: SYSTEM

 3/78  SYSTEM      90.0                    77.0        30.0                    720          215

              ** PROBLEMS/SOLUTIONS/COMMENTS
                   START DATE   3/78      EQUIPMENT: FGD SYSTEM, GENERAL
                   END DATE     3/78      COMMENTS:
                             THE FGD SYSTEM OPERATED FOR TEN DAYS.  OPERATION WAS INTERRUPTED BY SHUT-
                             DOWN OF THE UNIT 11 BOILER FOR REPAIR OF COAL GRINDING MILLS AND PRECIPITA
                             TORS.  PROPER CONDITIONS COULD NOT BE RE-ESTABLISHED FOR RE-START OF THE
                             FGD OPERATION BECAUSE OF COAL FEED AND GRINDING PROBLEMS CAUSED BY EXTREME
                             LY POOR QUALITY COAL.
                   AFFECTED MODULES: SYSTEM

              ** PROBLEMS/SOLUTIONS/COMMENTS
                   START DATE   3/78      EQUIPMENT: FAN
                   END DATE     3/78      COMMENT: PREVENTIVE MAINTENANCE
                             MAINTENANCE WAS PERFORMED ON THE BOOSTER BLOWER.
                   AFFECTED MODULES: SYSTEM

              ** PROBLEMS/SOLUTIONS/COMMENTS
                   START DATE   3/78      EQUIPMENT: GAS DAMPER
                   END DATE     3/78      PROBLEM: NOT DEFINED/SPECIFIED
                             OPERATING PROBLEMS WERE ENCOUNTERED WITH THE FLUE GAS ISOLATION DAMPER.
                   AFFECTED MODULES: SYSTEM

 4/78  SYSTEM        .0                      .0          .0                    720            0

              ** PROBLEMS/SOLUTIONS/COMMENTS
                   START DATE   4/78      EQUIPMENT: FAN
                   END DATE     4/78      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                             THE FLUE GAS BOOSTER BLOWER WAS OUT OF SERVICE FOR THIS ENTIRE PERIOD FOR
                             REBLADING.  THE FGD SYSTEM WAS INOPERABLE.
                   AFFECTED MODULES: SYSTEM

              ** PROBLEMS/SOLUTIONS/COMMENTS
                   START DATE   4/78      EQUIPMENT: GAS DAMPER
                   END DATE     4/78      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                             A FAILURE OF THE FLUE GAS ISOLATION DAMPER OCCURRED.
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-----------------------------------------PERFORMANCE DATA---------------------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL    PER  BOILER  FGD    CAP.
                                                                SO2  PART.  HOURS  HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- -----  -----  ------ ----- ------
              AFFECTED MODULES: SYSTEM

         ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    4/78      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE      4/78      COMMENTS:
                            A NEW SUPPLY OF HIGH SULFUR COAL WAS OBTAINED AND SUCCESSFULLY TESTED ON
                            UNIT 11 BOILER.  THIS COAL IS EXPECTED TO ALLEVIATE PAST DIFFICULTIES WITH
                            THE COAL FEED AND GRINDING SYSTEM.
              AFFECTED MODULES: SYSTEM

         ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    4/78      EQUIPMENT: FAN
              END DATE      4/78      COMMENT: PREVENTIVE MAINTENANCE
                            MAINTENANCE WAS PERFORMED ON THE BOILER I.D. FANS.
              AFFECTED MODULES: SYSTEM

         ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    4/78      EQUIPMENT: AUXILIARY EQUIPMENT
              END DATE      4/78      COMMENTS:
                            MAINTENANCE WAS PERFORMED ON THE BOILER I.D. FANS.
              AFFECTED MODULES: SYSTEM

         ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    4/78      EQUIPMENT: ABSORBER
              END DATE      4/78      COMMENT: PREVENTIVE MAINTENANCE
                            MAINTENANCE WAS PERFORMED ON THE FGD ABSORBER.
              AFFECTED MODULES: SYSTEM

5/78   SYSTEM
                                                                            720

         ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    5/78      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE      5/78      COMMENTS:
                            THE SO2 RECOVERY PORTION OF THE FGD SYSTEM OPERATED FOR 26 DAYS.  THE COM-
                            PLETED FGD SYSTEM OPERATED FOR 11 DAYS.
              AFFECTED MODULES: SYSTEM

         ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    5/78      EQUIPMENT: GAS DAMPER
              END DATE      5/78      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                            FGD OPERATIONS WERE INTERRUPTED BY FAILURE OF THE FLUE GAS ISOLATION DAMP-
                            ER.
              AFFECTED MODULES: SYSTEM

         ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    5/78      EQUIPMENT: BOILER-RELATED
              END DATE      5/78      COMMENTS:
                            FGD OPERATIONS WERE INTERRUPTED BY PROBLEMS WITH WET COAL WHICH REQUIRED
                            THE UNIT 11 BOILER TO OPERATE ON LOW SULFUR COAL FOR A SHORT PERIOD.
              AFFECTED MODULES: SYSTEM

         ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    5/78      EQUIPMENT: AUXILIARY EQUIPMENT
              END DATE      5/78      PROBLEM: CHEMICAL-RELATED PLUGGING
                            FGD OPERATIONS WERE INTERRUPTED BY PLUGGING OF AN ENTRAINMENT SEPARATOR IN
                            THE SO2 REDUCTION UNIT.
              AFFECTED MODULES: SYSTEM

6/78   SYSTEM       13.0                    1.0         .0                          720            300

         ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    6/78      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE      6/78      COMMENTS:
                            THE FGD PROCESS FACILITIES, CONSISTING OF THE ABSORBER, EVAPORATOR, SO2 RE
                            DUCTION AND PURGE TREATMENT UNITS, WERE AVAILABLE FOR OPERATION FOR ESSEN-
                            TIALLY THE ENTIRE PERIOD.
              AFFECTED MODULES: SYSTEM
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-------------------------------------------PERFORMANCE DATA-------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL    PER  BOILER   FGD   CAP.
                                                               SO2   PART. HOURS  HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   6/78      EQUIPMENT: FAN
            END DATE     6/78      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                         OPERATION OF THE FGD SYSTEM WAS LIMITED BY FAILURE OF THE BOOSTER BLOWER
                         DRIVE TURBINE.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   6/78      EQUIPMENT: GAS DAMPER
            END DATE     6/78      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                         OPERATION OF THE FGD SYSTEM WAS LIMITED DUE, IN PART, TO THE INABILITY OF
                         THE ISOLATION DAMPER TO OPERATE
            AFFECTED MODULES: SYSTEM

 7/78  SYSTEM       6.0                     4.0          2.0                       720          170

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   7/78      EQUIPMENT: FAN
            END DATE     7/78      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                         OPERATION OF THE FGD SYSTEM WAS LIMITED BY IMBALANCE OF THE BOOSTER BLOWER
                         DUE TO INABILITY OF THE ISOLATION DAMPER TO OPERATE, THIS CONDITION COULD
                         NOT BE CORRECTED UNTIL POWER DEMANDS PERMITTED A SHUT DOWN OF UNIT 11 BOIL
                         ER.  FLUE GAS BOOSTER BLOWER PROBLEMS INCLUDED LOW OIL PRESSURE, LEAKING
                         BEARING OIL SEALS AND DRIVE TURBINE GOVERNOR MALFUNCTION.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   7/78      EQUIPMENT: GAS DAMPER
            END DATE     7/78      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                         THE ISOLATION DAMPER WAS INOPERABLE OVER THE PERIOD.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   7/78      EQUIPMENT: BOILER-RELATED
            END DATE     7/78
                         RECURRING FLUCTUATIONS IN THE PRESSURE OF THE MAIN STEAM SUPPLY TO THE FGD
                         SYSTEM LIMITED FGD OPERATIONS.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   7/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     7/78      COMMENTS:
                         THE FGD PROCESS FACILITIES WERE AVAILABLE FOR OPERATION FOR THE INTIRE
                         PERIOD.
            AFFECTED MODULES: SYSTEM

 8/78  SYSTEM      98.0                    98.0         98.0                       720          707

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     8/78      COMMENTS:
                         THE UNIT 11 BOILER OPERATED CONTINUOUSLY ON HIGH SULFUR COAL THROUGHOUT TH
                         PERIOD.  THE FGD SYSTEM ACHIEVED FULL OPERATION ON THE FIRST DAY OF THE
                         PERIOD.  AFTER PROBLEMS WITH THE BOOSTER BLOWER WERE CORRECTED, IT REMAINE
                         IN FULL OPERATION FOR THE BALANCE OF THE PERIOD WITH THE EXCEPTION OF ONE
                         TWO-HOUR INTERRUPTION DUE TO AN ELECTRICAL MOTOR MALFUNCTION.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/78      EQUIPMENT: FAN
            END DATE     8/78      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                         MINOR BOOSTER BLOWER PROBLEMS OCCURRED OVER THE PERIOD.
            AFFECTED MODULES: SYSTEM

 9/78  SYSTEM      44.0                    99.0         44.0                       720          319
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----------------------------------------PERFORMANCE DATA---------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL    PER BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     9/78      COMMENTS:
                         THE UNIT 11 BOILER OPERATED ON HIGH SULFUR COAL UNTIL SEPTEMBER 12 WHEN IT
                         WAS SHUT DOWN FOR AN ANNUAL OVERHAUL.  THE BOILER REMAINED DOWN THROUGH TH
                         END OF THE PERIOD.  THE FGD SYSTEM CONTINUED IN FULL OPERATION UNTIL SEP-
                         TEMBER 12, WITH THE EXCEPTION OF ONE TWO-HOUR INTERRUPTION DUE TO A GOVER-
                         NOR MALFUNCTION ON THE SO2 COMPRESSOR DRIVE TURBINE, AND WAS THEN SHUT DOW
                         CONCURRENTLY WITH THE UNIT 11 BOILER.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/78      EQUIPMENT: AUXILIARY EQUIPMENT
            END DATE     9/78      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                         A GOVERNOR MALFUNCTION OCCURRED ON THE SO2 COMPRESSOR DRIVE TURBINE CAUS-
                         ING A TWO-HOUR OUTAGE ON THE FGD OPERATIONS.
            AFFECTED MODULES: SYSTEM

10/78  SYSTEM     44.0                     73.0        44.0                  640         369

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    10/78      COMMENTS:
                         THIS PERIOD COVERS SEPTEMBER 29 THROUGH NOVEMBER 2.  FOLLOWING THE ANNUAL
                         TURNAROUND, THE UNIT 11 BOILER RESTARTED ON OCTOBER 6.  A NEW BASELINE TES
                         WAS RUN ON THE BOILER OCTOBER 7 THROUGH 12.  BALANCING OF THE FLUE GAS
                         BOOSTER BLOWER WAS THEN COMPLETED AFTER WHICH THE FGD SYSTEM WAS STARTED O
                         OCTOBER 16.
            AFFECTED MODULES: SYSTEM

11/78  SYSTEM     99.0                     99.0        98.0                  720         709

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/78      EQUIPMENT: AUXILIARY EQUIPMENT
            END DATE    11/78      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                         PROBLEMS WERE ENCOUNTERED WITH THE SODIUM SULFATE PURGE DRYER WHICH NECES-
                         SITATED DISPOSING OF PART OF THE SULFATE PURGE TO THE BOTTOM ASH POND FOR
                         A PORTION OF THE PERIOD.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    11/78      COMMENTS:
                         THE UNIT 11 BOILER OPERATED CONTINUOUSLY ON HIGH SULFUR COAL EXCEPT FOR ON
                         THREE-HOUR OUTAGE FOR REPAIR OF A STEAM CONTROL VALVE.  VARIATIONS IN THE
                         PRESSURE OF THE STEAM SUPPLY TO FGD OCCURRED DUE TO HIGH SILICA IN THE
                         MAKE-UP WATER ON UNIT 11.
            AFFECTED MODULES: SYSTEM

12/78  SYSTEM     64.0                     72.0        64.0                  720         462

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/78      EQUIPMENT: BOILER-RELATED
            END DATE    12/78      PROBLEM: NOT DEFINED/SPECIFIED
                         THE BOILER WAS SHUT DOWN FROM DEC. 114 TO DEC. 17 TO CLEAN THE AIR
                         PREHEATERS.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/78      EQUIPMENT: BOILER-RELATED
            END DATE    12/78      COMMENTS:
                         THE BOILER OPERATED ON HIGH SULFUR COAL.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/78      EQUIPMENT: AUXILIARY EQUIPMENT
            END DATE    12/78      PROBLEM: WEATHER-RELATED COMPONENT FAILURE
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                                  SECTION 3
                   DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
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-------------------------------------------PERFORMANCE DATA-----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                          AN INSTRUMENT MALFUNCTION DUE TO FREEZING RESULTED IN THE PLUGGING OF A
                          HEAT EXCHANGER IN THE SO2 REGENERATION UNIT.  THE FGD SYSTEM WAS DOWN FOR
                          THREE DAYS WHILE THE EXCHANGER WAS CLEANED.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  12/78      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE    12/78      PROBLEM: NOT DEFINED/SPECIFIED
                          THE FGD SYSTEM WAS SHUT DOWN FOR THREE DAYS FOR CLEANING A HEAT EXCHANGER
                          IN THE SO2 REGENERATION UNIT.
              AFFECTED MODULES: SYSTEM

 1/79  SYSTEM     28.0                      28.0        28.0                        744         198

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   1/79      EQUIPMENT: BOILER-RELATED
              END DATE     1/79      COMMENTS:
                          THE BOILER OPERATED ON HIGH SULFUR COAL FROM JANUARY 2-14 AND LOW SULFUR
                          COAL JANUARY 15-31.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   1/79      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     1/79      COMMENTS:
                          INTEGRATED OPERATION OF THE FGD SYSTEM CONTINUED TO JANUARY 10 WHEN THE
                          SO2 REDUCTION UNIT WAS SHUT DOWN FOR REPAIR OF A SULFUR CONDENSER INCLUDIN
                          CORRECTIVE MEASURES TO AVOID FUTURE PROBLEMS WITH THE CONDENSER.  THE
                          ABSORPTION AND REGENERATION UNITS CONTINUED IN OPERATION TO JANUARY 29
                          WITH RECYCLE OF SO2 TO THE ABSORBER INLET.  THE FGD SYSTEM REMAINED DOWN
                          THROUGH JANUARY 31.
              AFFECTED MODULES: SYSTEM
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                                   SECTION 3
                DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
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 COMPANY NAME                                      NORTHERN STATES POWER
 PLANT NAME                                        SHERBURNE
 UNIT NUMBER                                       1
 CITY                                              BECKER
 STATE                                             MINNESOTA
 REGULATORY CLASSIFICATION                         B
 PARTICULATE EMISSION LIMITATION - NG/J              37.          (  .087 LB/MMBTU)
 SO2 EMISSION LIMITATION - NG/J                     413.          (  .960 LB/MMBTU)
 NET PLANT GENERATING CAPACITY - MW                3200.0
 GROSS UNIT GENERATING CAPACITY - MW                720.0
 NET UNIT GENERATING CAPACITY W/FGD - MW            680.0
 NET UNIT GENERATING CAPACITY WO/FGD - MW           700.0
 EQUIVALENT SCRUBBED CAPACITY - MW                  720.0

 ** BOILER DATA
     SUPPLIER                                      COMBUSTION ENGINEERING
     TYPE                                          PULVERIZED COAL, BALANCED DRAFT
     SERVICE LOAD                                  BASE
     COMMERCIAL SERVICE DATE                        0/76
     MAXIMUM BOILER FLUE GAS FLOW - CU.M/S          1349.16       (2859000 ACFM)
     FLUE GAS TEMPERATURE - C                        154.4        ( 310 F)
     STACK HEIGHT - M                              ******         (**** FT)
     STACK TOP DIAMETER - M                        *******        (***** FT)

 ** FUEL DATA
     FUEL TYPE                                     COAL
     FUEL GRADE                                    SUBBITUMINOUS
     AVERAGE HEAT CONTENT - KJ/KG                   19771.        (  8500 BTU/LB)
     RANGE HEAT CONTENT - BTU/LB                                     ******
     AVERAGE ASH CONTENT - %                           9.00
     RANGE ASH CONTENT - %                         ******
     AVERAGE MOISTURE CONTENT - %                     25.00
     RANGE MOISTURE CONTENT - %                    ******
     AVERAGE SULFUR CONTENT - %                         .80
     RANGE SULFUR CONTENT - %                      ******
     AVERAGE CHLORIDE CONTENT - %                  ********
     RANGE CHLORIDE CONTENT - %                    ******
     FUEL FIRING RATE - M T/H                        369.1        (407 TPH)
     FUEL FIRING RATE - MW                           680

 ** PARTICULATE SCRUBBER
     NUMBER                                        12
     TYPE                                          RECTANGULAR VARIABLE THROAT ROD DECK VENTURI
     SUPPLIER                                      COMBUSTION ENGINEERING
     NUMBER OF STAGES                                 2
     SHELL MATERIAL                                CARBON STEEL INLET, 316L SS SKIRT, 316L VENTURI
     INTERNAL MATERIAL                             316L SS RODS
     NUMBER OF NOZZLES                                26
     TYPE OF NOZZLES                               CERAMIC
     BOILER LOAD/SCRUBBER - %                          9.0
     FLUE GAS CAPACITY - CU.M/S                      122.6        ( 259900 ACFM)
     FLUE GAS TEMPERATURE - C                        154.4        (  310 F)
     LIQUID RECIRCULATION RATE - LITER/S             223.0        ( 3540 GPM)
     L/G RATIO - LITER/CU.M                            1.9        (14.0 GAL/1000ACF)
     PRESSURE DROP - KPA                               3.7        (    15 IN-H2O)
     SUPERFICIAL GAS VELOCITY - M/S                   24.4        (   80.0 FT/S)

 ** FGD SYSTEM
     SALEABLE PRODUCT/THROWAWAY PRODUCT            THROWAWAY PRODUCT
     GENERAL PROCESS TYPE                          WET SCRUBBING
     PROCESS TYPE                                  LIMESTONE/ALKALINE FLYASH
     SYSTEM SUPPLIER                               COMBUSTION ENGINEERING
     A-E FIRM                                      BLACK AND VEATCH
     DEVELOPMENT LEVEL                             FULL-SCALE
     NEW/RETROFIT                                  NEW
     PARTICULATE DESIGN REMOVAL EFFICIENCY - %        99.00
     SO2 DESIGN REMOVAL EFFICIENCY - %                50.00
     COMMERCIAL DATE                                3/76
     INITIAL START-UP                               3/76

 ** ABSORBER
     NUMBER                                        12
     TYPE                                          MARBLE BED
     INITIAL START UP                               3/76
     SUPPLIER                                      COMBUSTION ENGINEERING
     NUMBER OF STAGES                                 1
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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     DIMENSIONS                                 18X26.5
     SHELL MATERIAL                             CARBON STEEL (1/4 IN)
     SHELL LINER MATERIAL                       CEILCOTE FLAKE FIBERGLASS
     INTERNAL MATERIAL                          316LSS PERFORATED PLATE, FRP SPRAY HEADERS
     NUMBER OF NOZZLES                            54
     NOZZLE TYPE                                CERAMIC
     BOILER LOAD/ABSORBER - %                      9.0
     GAS FLOW - CU.M/S                            94.38        ( 200000 ACFM)
     GAS TEMPERATURE - C                          54.4         (  130 F)
     LIQUID RECIRCULATION RATE - LITER/S         120.          ( 1900 GPM)
     L/G RATIO - L/CU.M                            1.3         (  9.5 GAL/1000ACF)
     PRESSURE DROP - KPA                            .5         ( 2.0 IN-H2O)
     SUPERFICAL GAS VELOCITY - M/SEC               9.4         ( 31.0 FT/S)
     PARTICULATE INLET LOAD - G/CU.M               6.9         ( 3.000 GR/SCF)
     PARTICULATE OUTLET LOAD- G/CU.M                .1         (  .036 GR/SCF)
     PARTICULATE REMOVAL EFFICIENCY - %           99.0
     SO2 INLET CONCENTRATION - PPM               700
     SO2 OUTLET CONTRATION - PPM                 325
     SO2 DESIGN REMOVAL EFFICIENCY - %            55.0

  ** MIST ELIMINATOR
     NUMBER                                     12
     TYPE                                       CHEVRON
     CONSTRUCTION MATERIAL                      FRP
     CONFIGURATION                              HORIZONTAL
     NUMBER OF STAGES                              2
     NUMBER OF PASSES                              6
     FREEBOARD DISTANCE - M                        3.20       (10.5 FT)
     VANE SPACING - CM                            10.2        ( 4.00 IN)
     WASH SYSTEM                                INTERMITTENT UPWARD WASH ROTATABLE, 120-150 PSIG
     SUPERFICIAL GAS VELOCITY - M/S                9.4        ( 31.0 FT/S)
     PRESSURE DROP - KPA                            .0        (  .0 IN-H2O)

  ** PROCESS CONTROL CHEMISTRY
     CONTROL VARIABLES                          SLURRY PH, SLURRY SOLIDS, TANK LEVELS, PRESSURE
     CONTROL RANGE                              PRESSURE DROP 12 IN H2O, 10% SOLIDS, PH=5-515
     CONTROL MANNER                             AUTOMATIC
     MODE                                       FEEDBACK

  ** PUMPS
     SERVICE                                    NUMBER
     -------                                    ------
     POND RETURN WATER                             1
     THICKENER UNDERFLOW                           1
     MAKEUP WATER                                  1
     ******                                        2
     RECYCLE                                       2
     SPRAY                                        12

  ** TANKS
     SERVICE                                    NUMBER
     -------                                    ------
     REACTION                                      1
     MAKEUP WATER                                  1
     SLURRY MAKEUP                                 1

  ** REHEATER
     NUMBER                                     11
     TYPE                                       IN-LINE
     HEATING MEDIUM                             280 F HOT WATER
     TEMPERATURE BOOST - C                         22.2        (   40 F)
     ENERGY REQUIRED                            132 MM BTU/H

  ** THICKENER
     NUMBER                                      1
     TYPE                                       CENTER RAKE DRIVE
     DIAMETER - M                                  48.8        (160 FT)
     OUTLET SOLIDS - %                             28.0

  ** WATER LOOP
     TYPE                                       OPEN
```

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 ** REAGENT PREPARATION EQUIPMENT
     NUMBER OF BALL MILLS                           1
     BALL MILL CAPACITY- M T/H                     21.8        ( 24.0 TPH)
     REAGENT PRODUCT - % SLURRY SOLIDS             60.0

 ** TREATMENT
     TYPE                                       FORCIBLY OXIDIZED
     SUPPLIER                                   NONPROPRIETARY

 ** DISPOSAL
     NATURE                                     FINAL
     TYPE                                       LINED POND
     LOCATION                                   ON-SITE
     TRANSPORTATION                             PIPE
     AREA - ACRES                                 500.0
     CAPACITY - CU.M                              30575000     ( 25000.0 ACRE-FT)


-------------------------------------------PERFORMANCE DATA-----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION % REMOVAL    PER BOILER  FGD   CAP.
                                                               SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

 4/76  SYSTEM                                                                720

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   4/76     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     4/76     COMMENTS:
                          A PRELIMINARY SYSTEM CHECKOUT WAS SUCCESFULLY COMPLETED BY PASSING AIR AND
                          WATER THROUGH THE SYSTEM.
             AFFECTED MODULES: SYSTEM

 5/76  101                          62.0
        102                         83.0
        103                         81.0
        104                         59.0
        105                         72.0
        106                         90.0
        107                         57.0
        108                         69.0
        109                         60.0
        110                         75.0
        111                         72.0
        112                         67.0
       SYSTEM      86.0                                                      744   657          60.0

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   5/76     EQUIPMENT: SPRAY NOZZLES
             END DATE     6/76     PROBLEM: NOT DEFINED/SPECIFIED
                          MODIFICATIONS ARE CONTINUING ON THE SPRAY SYSTEM, SPRAY NOZZLES AND
                          STRAINER SYSTEM.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   5/76     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     5/76     COMMENTS:
                          FIRST COMMERCIAL OPERATION COMMENCED MAY 1, 1976.  THIS IS AN INTERMEDIATE
                          LOAD UNIT OPERATING NEAR FULL CAPACITY DURING THE DAY AND 35 PERCENT
                          CAPACITY AT NIGHT.
             AFFECTED MODULES: SYSTEM

 6/76  SYSTEM      84.0                                                      720   688          73.0

 7/76  101                          80.0
        102                         62.0
        103                         71.0
        104                         81.0
        105                         80.0
        106                         68.0
        107                         81.0
        108                         75.0
```

PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
	109		79.0								
	110		63.0								
	111		91.0								
	112		69.0								
	SYSTEM	84.0						744	512		51.0

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 7/76 EQUIPMENT: SPRAY NOZZLES
END DATE 8/76 PROBLEM: CHEMICAL-RELATED PLUGGING
THE SLURRY NOZZLES ARE FREQUENTLY PLUGGED BY PARTICLES ABOVE QUARTER INCH SIZE. STRAINER MODIFICATIONS ARE PLANNED TO ALLEVIATE THIS PROBLEM.
AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 7/76 EQUIPMENT: ABSORBER
END DATE 8/76 PROBLEM: CHEMICAL-RELATED SCALING
HARD SCALE GYPSUM FORMATION ON THE VESSEL WALLS HAS LEVELED OFF. THE CLEANING PROCEDURE CALLS FOR 3-4 MODULES TO BE TAKEN OUT OF SERVICE EACH NIGHT. THUS, EACH MODULE IS CLEANED ONCE EVERY 3 DAYS.
AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 7/76 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 8/76 COMMENTS:
A CREW OF 70 PEOPLE IS REQUIRED TO MAINTAIN SCRUBBER OPERATIONS.
AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 7/76 EQUIPMENT: RECYCLE TANK
END DATE 8/76 PROBLEM: CHEMICAL-RELATED SCALING
THE DEPOSITION OF SOFT SOLIDS IS STILL CONTINUING IN THE REHEATERS.
AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 7/76 EQUIPMENT: MIST ELIMINATOR
END DATE 8/76 PROBLEM: CHEMICAL-RELATED SCALING
THE DEPOSITION OF SOFT SOLIDS IS STILL CONTINUING IN THE MIST ELIMINATORS.
AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
8/76	101		46.0								
	102		93.0								
	103		51.0								
	104		84.0								
	105		83.0								
	106		76.0								
	107		71.0								
	108		84.0								
	109		81.0								
	110		76.0								
	111		87.0								
	112		91.0								
	SYSTEM	94.0						744	705		80.0
9/76	101		87.0								
	102		90.0								
	103		93.0								
	104		76.0								
	105		76.0								
	106		79.0								
	107		85.0								
	108		79.0								
	109		85.0								
	110		80.0								
	111		92.0								
	112		96.0								
	SYSTEM	95.0						720	566		68.0

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----------------------------------------PERFORMANCE DATA-----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                               SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/76     EQUIPMENT: SPRAY NOZZLES
            END DATE    10/76     PROBLEM: NOT DEFINED/SPECIFIED
                                  THE STRAINER SYSTEM IS BEING MODIFIED.  THE DUPLEX UNITS ARE TO BE
                                  REPLACED BY IN-TANK SCREENS AND WASH LANCES.  BOTH ARE LOCATED AT THE
                                  SUCTION SIDE OF THE SPRAY WATER PUMP.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/76     EQUIPMENT: REHEATER
            END DATE    10/76     PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                                  CARBON STEEL FIN TUBE REHEAT BUNDLES ARE AN AREA OF CONCERN.  MULTIPLE
                                  FAILURES IN FOUR UNITS HAVE BEEN EXPERIENCED.
            AFFECTED MODULES: SYSTEM

10/76  101                        97.0
        102                       84.0
        103                       96.0
        104                       96.0
        105                       95.0
        106                       30.0
        107                       74.0
        108                       76.0
        109                       91.0
        110                       81.0
        111                      100.0
        112                       87.0
       SYSTEM                    100.0                                       744   606

11/76  101                        83.0
        102                       80.0
        103                       87.0
        104                       79.0
        105                       92.0
        106                       80.0
        107                       93.0
        108                       89.0
        109                       69.0
        110                       78.0
        111                       73.0
        112                       93.0
       SYSTEM        93.0                                                    720   720          92.0

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/76     EQUIPMENT: SPRAY NOZZLES
            END DATE    12/76     PROBLEM: NOT DEFINED/SPECIFIED
                                  APPROXIMATELY ONE-THIRD OF THE STRAINER MODIFICATIONS ON MODULE 101 ARE
                                  COMPLETED.
            AFFECTED MODULES: 101

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/76     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    12/76     COMMENTS:
                                  THE UNIT IS CURRENTLY HAVING DIFFICULTY COMPLYING WITH THE 20 PERCENT
                                  OPACITY REGULATION DUE TO THE EXTREMELY FINE FLY ASH BEING EMITTED (70
                                  PERCENT LESS THAN 1 MICRON).
            AFFECTED MODULES: SYSTEM

12/76  101                        88.0
        102                       84.0
        103                       67.0
        104                       80.0
        105                       71.0
        106                       97.0
        107                       91.0
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
	108		95.0								
	109		94.0								
	110		88.0								
	111		73.0								
	112		75.0								
	SYSTEM	95.0						744	722		91.0

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 12/76 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 12/76 COMMENTS:
THE UTILITY IS NOW CONDUCTING A FULL-LOAD EVALUATION STUDY, ANALYZING SYSTEM OPERATION ON 10 MODULES VS. THE DESIGNED 11 MODULES.
AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
1/77	101		94.0								
	102		75.0								
	103		99.0								
	104		76.0								
	105		96.0								
	106		77.0								
	107		70.0								
	108		92.0								
	109		81.0								
	110		40.0								
	111		75.0								
	112		95.0								
	SYSTEM	90.0						744	607		73.0
2/77	101		89.0								
	102		99.0								
	103		64.0								
	104		96.0								
	105		64.0								
	106		99.0								
	107		81.0								
	108		62.0								
	109		98.0								
	110		93.0								
	111		98.0								
	112		61.0								
	SYSTEM	91.0						672	609		83.0
3/77	101		47.0								
	102		92.0								
	103		95.0								
	104		93.0								
	105		93.0								
	106		95.0								
	107		88.0								
	108		93.0								
	109		95.0								
	110		83.0								
	111		78.0								
	112		72.0								
	SYSTEM	95.0						744	743		97.0

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 3/77 EQUIPMENT: SPRAY NOZZLES
END DATE 3/77 PROBLEM: NOT DEFINED/SPECIFIED
ALL MODULES ARE NOW FITTED WITH IN-TANK STRAINERS.
AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
4/77	101		84.0								
	102		65.0								
	103		92.0								
	104		95.0								

PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
	105		96.0								
	106		62.0								
	107		73.0								
	108		91.0								
	109		58.0								
	110		93.0								
	111		90.0								
	112		88.0								
	SYSTEM	95.0						720	718		90.0
5/77	101		96.0								
	102		48.0								
	103		92.0								
	104		87.0								
	105		95.0								
	106		96.0								
	107		81.0								
	108		98.0								
	109		96.0								
	110		78.0								
	111		35.0								
	112		87.0								
	SYSTEM	92.0						744	312		37.0

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 5/77 EQUIPMENT: BOILER-RELATED
END DATE 6/77 COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
A SCHEDULED TURBINE OVERHAUL LASTED FROM MAY 14 TO JUNE 18.
AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
6/77	101		76.0								
	102		77.0								
	103		75.0								
	104		75.0								
	105		30.0								
	106		87.0								
	107		58.0								
	108		44.0								
	109		61.0								
	110		80.0								
	111										
	112		83.0								
	SYSTEM							720	248		25.0
7/77	101		93.0								
	102		66.0								
	103		92.0								
	104		90.0								
	105		92.0								
	106		94.0								
	107		91.0								
	108		17.0								
	109		94.0								
	110		83.0								
	111		78.0								
	112		83.0								
	SYSTEM	97.0						744	736		90.0

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 7/77 EQUIPMENT: ABSORBER
END DATE 7/77 PROBLEM: NOT DEFINED/SPECIFIED
SOME STAINLESS STEEL MODIFICATIONS TOOK PLACE.
AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 7/77 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 7/77 COMMENTS:

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------------------------------------------PERFORMANCE DATA-----------  ----------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                                WHILE THE UNIT WAS OUT IN JUNE THE FGD SYSTEM WAS CLEANED.  THIS CLEANING
                                WAS CREDITED FOR ONE OF THE HIGHEST AVAILABILITIES EVER DEMONSTRATED ON
                                THIS UNIT.
                     AFFECTED MODULES: SYSTEM

 8/77   101                     85.0
         102                    89.0
         103                    66.0
         104                    55.0
         105                    81.0
         106                    90.0
         107                    83.0
         108                    79.0
         109                    72.0
         110                    85.0
         111                    90.0
         112                    66.0
        SYSTEM       95.0                                                  744   640          68.0

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    8/77      EQUIPMENT: ABSORBER
             END DATE      9/77      PROBLEM: NOT DEFINED/SPECIFIED
                                SOME ANGLES WERE INSTALLED ON THE PRIMARY CONTACTOR RODS TO RESIST EROSION
             AFFECTED MODULES: SYSTEM

 9/77   101                     86.0
         102                    85.0
         103                    88.0
         104                    92.0
         105                    88.0
         106                    62.0
         107                    83.0
         108                    90.0
         109                    86.0
         110                    77.0
         111                    77.0
         112                    82.0
        SYSTEM       95.0                                                  720   686          81.0

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    9/77      EQUIPMENT: PUMP, OTHER
             END DATE     10/77      PROBLEM: NOT DEFINED/SPECIFIED
                                TWENTY-FOUR PUMPS ARE BEING COMPLETELY OVERHAULED.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    9/77      EQUIPMENT: PUMP, OTHER
             END DATE      9/77      PROBLEM: MATERIALS FAILURE,OTHER
                                MODULE 106 SPRAY WATER PUMP WAS OVER HAULED IN SEPTEMBER.
             AFFECTED MODULES: 106

10/77   101                     70.0
         102                    81.0
         103                    95.0
         104                    97.0
         105                    63.9
         106                    35.0
         107                    87.0
         108                    99.0
         109                    96.0
         110                    39.0
         111                    58.0
         112                    96.0
        SYSTEM       68.0                                                  744   609          68.0

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   10/77      EQUIPMENT: SPRAY NOZZLES
             END DATE     11/77      PROBLEM: NOT DEFINED/SPECIFIED
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------------------------------------------PERFORMANCE DATA-----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION % REMOVAL    PER BOILER  FGD    CAP.
                                                               SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
                           STRAINER/WASHER SCREEN EROSION HAS BEEN A PROBLEM.  REPAIR AND REPLACEMENT
                           HAS BEEN CONTINUALLY NECESSARY.  316 SS MATERIAL WILL BE USED IN THE
                           FUTURE.
              AFFECTED MODULES: SYSTEM

11/77  101                    77.0
       102                    91.0
       103                    42.0
       104                    86.0
       105                    79.0
       106                    82.0
       107                    87.0
       108                    91.0
       109                    89.0
       110                    89.0
                  92.0        92.0
       112                    52.0
       SYSTEM     92.0                                                     720   705          81.0

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  12/77     EQUIPMENT: SPRAY NOZZLES
              END DATE     1/78     PROBLEM: NOT DEFINED/SPECIFIED
                           THE REPLACEMENT PROGRAM HAS BEGUN ON DECEMBER 21, 1977. IT TAKES 4.TO 6
                           DAYS FOR WORK ON EACH MODULE TO REPLACE THE STRAINER SYSTEM.
              AFFECTED MODULES: SYSTEM

12/77  101                    97.0
       102                    90.0
       103                    95.0
       104                    94.0
       105                    71.0
       106                    92.0
       107                    26.0
       108                    67.0
       109                    96.0
       110                    98.0
       111                    95.0
       112                    90.0
       SYSTEM     93.0                                                     744   557          62.0

 1/78  101                    83.0
       102                    63.0
       103                    88.0
       104                    73.0
       105                    84.0
       106                    84.0
       107                    92.0
       108                    64.0
       109                    91.0
       110                    80.0
       111                    88.0
       112                    82.0
       SYSTEM     92.0                                                     744   648          71.0

 2/78  101
       102                    93.0
       103                    92.0
       104                    89.0
       105                    74.0
       106                    85.0
       107                    89.0
       108                    88.0
       109                    76.0
       110                    86.0
       111                    88.0
       112                    87.0
       SYSTEM     92.0                                                     672   636          77.0
```

```
------------------------------------------------------------------------------------------------------



-------------------------------------------PERFORMANCE DATA-------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD    CAP.
                                                                 SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- -----  ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   2/78     EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     3/78     COMMENTS:
                           MODULES WHICH ARE SHOWING AVAILABILITY OF LESS THAN 80 PERCENT, ARE
                           THOSE IN WHICH THE STRAINER MODIFICATIONS WERE PERFOMED.
              AFFECTED MODULES: 101     103     107     110

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   2/78     EQUIPMENT: ABSORBER
              END DATE     2/78     PROBLEM: NOT DEFINED/SPECIFIED
                           A BULK ENTRAINMENT SEPARATOR WAS INSTALLED ALONG WITH A KOCH WASH TRAY.
              AFFECTED MODULES: SYSTEM

 3/78  101                      71.0
        102                     83.0
        103                     64.0
        104                     89.0
        105                     90.0
        106                     83.0
        107                     62.0
        108                     89.0
        109                     97.0
        110                     71.0
        111                     79.0
        112                     90.0
       SYSTEM      92.0                                                           744   676          80.0

 4/78  101                      92.0
        102                     87.0
        103                     87.0
        104                     44.0
        105                     81.0
        106                     85.0
        107                     91.0
        108                     86.0
        109                     92.0
        110                     91.0
        111                     87.0
        112                     52.0
       SYSTEM      95.0                                                           720   713          91.0

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   4/78     EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     4/78     COMMENTS:
                           STRAINER MODIFICATIONS WERE PERFORMED ON MODULES 104 AND 112.
              AFFECTED MODULES: 104     112

 5/78  101                      61.0
        102                     86.0
        103                     85.0
        104                     86.0
        105                     89.0
        106                     64.0
        107                     62.0
        108                     83.0
        109                     82.0
        110                     71.0
        111                     87.0
        112                     79.0
       SYSTEM      95.0                                                           744   635          72.0

 6/78  101                      50.0
        102                     84.0
        103                     85.0
        104                     85.0
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
	105		62.0								
	106		78.0								
	107		55.0								
	108		83.0								
	109		88.0								
	110		82.0								
	111		72.0								
	112		95.0								
	SYSTEM	93.0						720	717		81.0
7/78	101		82.0								
	102		76.0								
	103		71.0								
	104		74.0								
	105		75.0								
	106		52.0								
	107		75.0								
	108		63.0								
	109		62.0								
	110		72.0								
	111		66.0								
	112		73.0								
	SYSTEM	95.0						744	694		75.0

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 7/78 EQUIPMENT: MIST ELIMINATOR
END DATE 7/78 PROBLEM: CHEMICAL-RELATED PLUGGING
THE OCCURRANCE OF PLUGGING PROBLEMS IN THE MIST ELIMINATOR HAS BEEN MORE FREQUENT THAN NORMAL.
AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 7/78 EQUIPMENT: SPRAY NOZZLES
END DATE 7/78 PROBLEM: NOT DEFINED/SPECIFIED
STRAINER MODIFICATIONS CONTINUE.
AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 7/78 EQUIPMENT: PUMP, OTHER
END DATE 7/78 PROBLEM: NOT DEFINED/SPECIFIED
THE UTILITY IS EVALUATING NEW RUBBER LINED PUMPS (,///GPM) TO HELP CORRECT THE REHEATER AND MIST ELIMINATOR PLUGGING PROBLEMS
AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 7/78 EQUIPMENT: RECYCLE TANK
END DATE 7/78 PROBLEM: CHEMICAL-RELATED PLUGGING
THE OCCURANCE OF PLUGGING PROBLEMS IN THE REHEATER HAS BEEN MORE FREQUENT THAN NORMAL
AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 7/78 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 7/78 COMMENTS:
THE UTILITY IS PREPARING FOR THE STATE COMPLIANCE DEADLINE ON NOV. 1,1978. CURRENTLY TESTING HAS BEEN PROCEEDING ON DIFFERENT MODULES IN AN EFFORT TO FINE TUNE THE SYSTEM.
AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 7/78 EQUIPMENT: ABSORBER
END DATE 7/78 PROBLEM: CHEMICAL-RELATED EROSION
THE FGD SYSTEM HAS BEEN EXPERIENCING PRIMARY CONTACTOR WALL AND MARBLE BED WEAR.
AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 7/78 EQUIPMENT: MIST ELIMINATOR
END DATE 7/78 PROBLEM: NOT DEFINED/SPECIFIED

PERFORMANCE DATA

THE UTILITY IS EVALUATING NEW STAINLESS STEEL MIST ELIMINATOR WASH LANCES (TO REPLACE THE ORIGINAL FIBERGLASS LANCES) TO HELP CORRECT THE REHEATER AND MIST ELIMINATOR PLUGGING PROBLEMS.

AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
8/78	101		64.0								
	102		65.0								
	103		73.0								
	104		63.0								
	105		65.0								
	106		80.0								
	107		81.0								
	108		73.0								
	109		63.0								
	110		73.0								
	111		64.0								
	112		83.0								
	SYSTEM	91.0						744	742		79.0
9/78	101		89.0								
	102		62.0								
	103		77.0								
	104		77.0								
	105		58.0								
	106		82.0								
	107		68.0								
	108		68.0								
	109		80.0								
	110		80.0								
	111		55.0								
	112		75.0								
	SYSTEM	97.0						720	357		36.0

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 9/78 EQUIPMENT: MIST ELIMINATOR
END DATE 9/78 PROBLEM: CHEMICAL-RELATED PLUGGING

DIFFERENT MIST ELIMINATOR SPRAY PATTERNS ARE BEING TESTED AS POSSIBLE SOLUTION TO THE MIST ELIMINATOR PLUGGING PROBLEM REFERRED TO IN JULU

AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 9/78 EQUIPMENT: BOILER-RELATED
END DATE 10/78 COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE

THE BOILER WAS TAKEN OFF LINE ON SEPTEMBER 15, 1978 FOR A SCHEDULED ANNUAL BOILER AND TURBINE INSPECTION. THE BO ILER CAME BACK ON LINE IN THE MIDDLE OF OCTOBER.

AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 9/78 EQUIPMENT: PUMP, OTHER
END DATE 9/78 PROBLEM: NOT DEFINED/SPECIFIED

THE RUBBER LINED PUMPS THAT THE UTILITY WAS INVESTIGATING IN JULY, 1978 HAVE BEEN ORDERED. FOUR OF THE PUMPS HAVE BEEN RECEIVED AND ONE IS INSTALLED. THE OTHERS WILL BE INSTALLED AS THEY COME IN

AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
10/78	101		95.0								
	102		65.0								
	103		88.0								
	104		81.0								
	105		71.0								
	106		78.0								
	107		77.0								
	108		63.0								
	109		85.0								
	110		61.0								

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-------------------------------------------PERFORMANCE DATA-----------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- -----  ----- ------
       111                     84.0
       112                     70.0
       SYSTEM      92.0                                                     744   375          37.0

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/78      EQUIPMENT: PUMP, OTHER
            END DATE    10/78      PROBLEM: NOT DEFINED/SPECIFIED
                        THE 2 IN. DIA. SS RODS IN THE PRIMARY CONTACTOR WERE REPLACED WITH 6(5/8)
                        DIA. CERAMIC COATED C.S. RODS. THE CERAMIC SLEEVES ARE 9/16 IN. THICK.
                        PREPARING THE MODULE FOR FURTHER TESTING.
            AFFECTED MODULES: 104    107    110    101    101

11/78  101                     42.0
       102                     51.0
       103                     88.0
       104                     81.0
       105                     71.0
       106                     78.0
       107                     77.0
       108                     63.0
       109                     85.0
       110                     61.0
       111                     64.0
       112                     70.0
       SYSTEM      92.0                                                     720                79.0

12/78  101                     77.0
        102                    73.0
        103                    77.0
        104                    73.0
        105                    86.0
        106                    87.0
        107                    93.0
        108                    85.0
        109                    93.0
        110                    86.0
        111                    90.0
        112                    88.0
       SYSTEM                                                               744   733          76.5

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     1/79      PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                        THE PROBLEMS ENCOUNTERED WERE MAINLY WEATHER RELATED.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/78      EQUIPMENT: ABSORBER
            END DATE     1/79      COMMENTS: RESEARCH AND DEVELOPMENT
                        THE TESTING ON MODULE 101 HAS BEEN COMPLETED BUT NO RESULTS ARE YET
                        AVAILABLE.
            AFFECTED MODULES: 101

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/78      EQUIPMENT: BOILER-RELATED
            END DATE     1/79
                        THERE WERE PROBLEMS WITH THE COAL FEEDER BELTS RESULTING IN MOVING COAL
                        FROM COAL STOCKPILES TO THE BOILER.
            AFFECTED MODULES: SYSTEM

 1/79  101                     72.0
        102                    39.0
        103                    76.0
        104                    95.0
        105                    73.0
        106                    95.0
```

PERFORMANCE DATA											
PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
	107		81.0								
	108		89.0								
	109		96.0								
	110		92.0								
	111		83.0								
	112		93.0								
	SYSTEM							744	688		65.8

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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 COMPANY NAME                                     NORTHERN STATES POWER
 PLANT NAME                                       SHERBURNE
 UNIT NUMBER                                      2
 CITY                                             BECKER
 STATE                                            MINNESOTA
 REGULATORY CLASSIFICATION                        B
 PARTICULATE EMISSION LIMITATION - NG/J             37.        (  .087 LB/MMBTU)
 SO2 EMISSION LIMITATION - NG/J                    413.        (  .960 LB/MMBTU)
 NET PLANT GENERATING CAPACITY - MW               3200.0
 GROSS UNIT GENERATING CAPACITY - MW               720.0
 NET UNIT GENERATING CAPACITY W/FGD - MW           680.0
 NET UNIT GENERATING CAPACITY WO/FGD - MW          700.0
 EQUIVALENT SCRUBBED CAPACITY - MW                 720.0

 ** BOILER DATA
     SUPPLIER                                     COMBUSTION ENGINEERING
     TYPE                                         PULVERIZED COAL, BALANCED DRAFT
     SERVICE LOAD                                 BASE
     COMMERCIAL SERVICE DATE                       0/77
     MAXIMUM BOILER FLUE GAS FLOW - CU.M/S         1349.16     (2859000 ACFM)
     FLUE GAS TEMPERATURE - C                       154.4      ( 310 F)
     STACK HEIGHT - M                             ******       (**** FT)
     STACK TOP DIAMETER - M                       *******      (***** FT)

 ** FUEL DATA
     FUEL TYPE                                    COAL
     FUEL GRADE                                   SUBBITUMINOUS
     AVERAGE HEAT CONTENT - KJ/KG                  19771.      (  8500 BTU/LB)
     RANGE HEAT CONTENT - BTU/LB                                 ******
     AVERAGE ASH CONTENT - %                           9.00
     RANGE ASH CONTENT - %                        ******
     AVERAGE MOISTURE CONTENT - %                     25.00
     RANGE MOISTURE CONTENT - %                   ******
     AVERAGE SULFUR CONTENT - %                         .80
     RANGE SULFUR CONTENT - %                     ******
     AVERAGE CHLORIDE CONTENT - %                 ********
     RANGE CHLORIDE CONTENT - %                   ******
     FUEL FIRING RATE - M T/H                       369.1      (407 TPH)
     FUEL FIRING RATE - MW                          680

 ** PARTICULATE SCRUBBER
     NUMBER                                       12
     TYPE                                         RECTANGULAR VARIABLE THROAT ROD DECK VENTURI
     SUPPLIER                                     COMBUSTION ENGINEERING
     NUMBER OF STAGES                                 2
     SHELL MATERIAL                               CARBON STEEL INLET, 316L SS SKIRT, 316L VENTURI
     INTERNAL MATERIAL                            316L SS RODS
     NUMBER OF NOZZLES                               26
     TYPE OF NOZZLES                              CERAMIC
     BOILER LOAD/SCRUBBER - %                         9.0
     FLUE GAS CAPACITY - CU.M/S                     122.6      ( 259900 ACFM)
     FLUE GAS TEMPERATURE - C                       154.4      (  310 F)
     LIQUID RECIRCULATION RATE - LITER/S            223.0      ( 3540 GPM)
     L/G RATIO - LITER/CU.M                           1.9      (14.0 GAL/1000ACF)
     PRESSURE DROP - KPA                              3.7      (    15 IN-H2O)
     SUPERFICIAL GAS VELOCITY - M/S                  24.4      (    80.0 FT/S)

 ** FGD SYSTEM
     SALEABLE PRODUCT/THROWAWAY PRODUCT           THROWAWAY PRODUCT
     GENERAL PROCESS TYPE                         WET SCRUBBING
     PROCESS TYPE                                 LIMESTONE/ALKALINE FLYASH
     SYSTEM SUPPLIER                              COMBUSTION ENGINEERING
     A-E FIRM                                     BLACK AND VEACH
     DEVELOPMENT LEVEL                            FULL-SCALE
     NEW/RETROFIT                                 NEW
     PARTICULATE DESIGN REMOVAL EFFICIENCY - %       99.00
     SO2 DESIGN REMOVAL EFFICIENCY - %               50.00
     COMMERCIAL DATE                               4/77
     INITIAL START-UP                              4/77

 ** ABSORBER
     NUMBER                                       12
     TYPE                                         MARBLE BED
     INITIAL START UP                              4/77
     SUPPLIER                                     COMBUSTION ENGINEERING
     NUMBER OF STAGES                                 1
```

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      DIMENSIONS                              18X26.5
      SHELL MATERIAL                          CARBON STEEL (1/4 IN)
      SHELL LINER MATERIAL                    CEILCOTE FLAKE FIBERGLASS
      INTERNAL MATERIAL                       316L SS PERFORATED PLATE, FRP SPRAY HEADERS
      NUMBER OF NOZZLES                          54
      NOZZLE TYPE                             CERAMIC
      BOILER LOAD/ABSORBER - %                    0.0
      GAS FLOW - CU.M/S                          94.38       ( 200000 ACFM)
      GAS TEMPERATURE - C                        54.4        (  130 F)
      LIQUID RECIRCULATION RATE - LITER/S       120.         ( 1900 GPM)
      L/G RATIO - L/CU.M                          1.3        (   9.5 GAL/1000ACF)
      PRESSURE DROP - KPA                          .5        ( 2.0 IN-H2O)
      SUPERFICAL GAS VELOCITY - M/SEC             9.4        ( 31.0 FT/S)
      PARTICULATE INLET LOAD - G/CU.M             6.9        ( 3.000 GR/SCF)
      PARTICULATE OUTLET LOAD- G/CU.M              .1        (   .036 GR/SCF)
      PARTICULATE REMOVAL EFFICIENCY - %         99.0
      SO2 INLET CONCENTRATION - PPM             700
      SO2 OUTLET CONTRATION - PPM               325
      SO2 DESIGN REMOVAL EFFICIENCY - %          55.0

** FANS
      NUMBER                                   4
      TYPE                                    SCRUBBER I.D.
      CONSTRUCTION MATERIALS                  CARBON STEEL

** MIST ELIMINATOR
      NUMBER                                  12
      TYPE                                    CHEVRON
      CONSTRUCTION MATERIAL                   FRP
      CONFIGURATION                           HORIZONTAL
      NUMBER OF STAGES                            2
      NUMBER OF PASSES                            6
      FREEBOARD DISTANCE - M                      3.20         (10.5 FT)
      VANE SPACING - CM                          10.2          ( 4.00 IN)
      WASH SYSTEM                             INTERMITTENT UPWARD WASH ROTATABLE, 120-150 PSIG
      SUPERFICIAL GAS VELOCITY - M/S              9.4          ( 31.0 FT/S)
      PRESSURE DROP - KPA                          .0          (  .0 IN-H2O)

** PROCESS CONTROL CHEMISTRY
      CONTROL VARIABLES                       SLURRY PH, SLURRY SOLIDS, TANK LEVELS, PRESSURE
      CONTROL RANGE                           PRESSURE DROP 12 IN H2O, 10% SOLIDS, PH=5-5.5
      CONTROL MANNER                          AUTOMATIC
      MODE                                    FEEDBACK

** PUMPS
      SERVICE                                 NUMBER
      -------                                 ------
      POND RETURN WATER                          1
      THICKENER UNDERFLOW                        1
      MAKEUP WATER                               1
      ******                                     2
      RECYCLE                                    2
      SPRAY                                     12

** TANKS
      SERVICE                                 NUMBER
      -------                                 ------
      REACTION                                   1
      MAKEUP WATER                               1
      SLURRY MAKEUP                              1

** REHEATER
      NUMBER                                  11
      TYPE                                    IN-LINE
      HEATING MEDIUM                          280 F HOT WATER
      TEMPERATURE BOOST - C                      22.2          (   40 F)
      ENERGY REQUIRED                         132 MM BTU/H

** THICKENER
      NUMBER                                   1
      TYPE                                    CENTER RAKE DRIVE
      DIAMETER - M                               48.8          (160 FT)
      OUTLET SOLIDS - %                          28.0
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

** WATER LOOP		
TYPE	OPEN	
** REAGENT PREPARATION EQUIPMENT		
NUMBER OF BALL MILLS	1	
BALL MILL CAPACITY- M T/H	21.8	(24.0 TPH)
REAGENT PRODUCT - % SLURRY SOLIDS	60.0	
** TREATMENT		
TYPE	FORCIBLY OXIDIZED	
SUPPLIER	NONPROPRIETARY	
** DISPOSAL		
NATURE	FINAL	
TYPE	LINED POND	
LOCATION	ON-SITE	
TRANSPORTATION	PIPE	
AREA - ACRES	500.0	
CAPACITY - CU.M	30575000	(25000.0 ACRE-FT)

PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
4/77	201										
	202		95.0								
	203		93.0								
	204		87.0								
	205		83.0								
	206		84.0								
	207		94.0								
	208		74.0								
	209		91.0								
	210		87.0								
	211		85.0								
	212		86.0								
	SYSTEM	92.0				57.50	99.00	720	697		78.0
5/77	211		91.0								
	212		98.0								
	209		94.0								
	208		98.0								
	206		100.0								
	203		44.0								
	204		95.0								
	201		33.0								
	202		100.0								
	SYSTEM	91.0						744	644		75.0
6/77	201		92.0								
	202		76.0								
	203		78.0								
	204		79.0								
	205		89.0								
	206		74.0								
	207		67.0								
	208		88.0								
	209		88.0								
	210		78.0								
	211		45.0								
	212		85.0								
	SYSTEM	96.0						720	720		83.0

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 6/77 EQUIPMENT: RECYCLE TANK

END DATE 7/77 PROBLEM: NOT DEFINED/SPECIFIED

CRACKING AND BUBBLING OF THE CEILCOTE LINING HAS BEEN OBSERVED ABOVE THE LIQUID LEVEL OF THE INTERNAL RECYCLE TANK.

AFFECTED MODULES: SYSTEM

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

				PERFORMANCE DATA							
PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
7/77	201		96.0								
	202		87.0								
	203		86.0								
	204		97.0								
	205		96.0								
	206		88.0								
	207		88.0								
	208		95.0								
	209		57.0								
	210		93.0								
	211		94.0								
	212		87.0								
	SYSTEM	97.0						744	602		72.0
8/77	201		88.0								
	202		75.0								
	203		67.0								
	204		82.0								
	205		84.0								
	206		35.0								
	207		81.0								
	208		80.0								
	209		56.0								
	210		79.0								
	211		71.0								
	212		33.0								
	SYSTEM	93.0						744	675		69.0

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 8/77 EQUIPMENT: PUMP, OTHER
END DATE 9/77 PROBLEM: NOT DEFINED/SPECIFIED
SPRAY PUMPS WERE OVERHAULED.
AFFECTED MODULES: 206 209

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 8/77 EQUIPMENT: SPRAY NOZZLES
END DATE 9/77 PROBLEM: NOT DEFINED/SPECIFIED
THE SPRAY NOZZLES REQUIRED EXTENSIVE CLEANING.
AFFECTED MODULES: 206 209

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
9/77	201		89.0								
	202		61.0								
	203		82.0								
	204		90.0								
	205		81.0								
	206		82.0								
	207		52.0								
	209		56.0								
	210		87.0								
	211		73.0								
	212		86.0								
	SYSTEM	94.0						720	717		83.0

** PROBLEMS/SOLUTIONS/COMMENTS
START DATE 8/77 EQUIPMENT: TANK, OTHER
END DATE 9/77 PROBLEM: CHEMICAL-RELATED EROSION
THE STRAINERS IN THE REACTION TANK HAVE STARTED ERODING. NSP ANTICIPATES REPLACING THEM VERY SOON.
AFFECTED MODULES: 207 209

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
10/77	201		98.0								
	202		89.0								
	203		87.0								
	204		86.0								
	205		62.0								

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
	207		98.0								
	206		99.0								
	208		93.0								
	209		96.0								
	210		96.0								
	212		81.0								
	SYSTEM	95.0						744	684		85.0

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 10/77 EQUIPMENT: PUMP, OTHER
END DATE 11/77 PROBLEM: NOT DEFINED/SPECIFIED

THE LOW OPERABILITIES ARE DUE TO SPRAY WATER PUMP OVERHAULS. 24 PUMPS ARE BEING OVERHAULED.

AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 10/77 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 11/77 PROBLEM: CHEMICAL-RELATED EROSION

STRAINER/WASHER SCREEN EROSION HAS BEEN A PROBLEM. 316 SS MATERIAL WILL BE USED IN THE FUTURE. REPLACEMENT MATERIAL IS EXPECTED TO ARRIVE IN DECEMBER AND WORK IS EXPECTED TO LAST FOR THREE MONTHS.

AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
11/77	201		85.0								
	202		93.0								
	203		68.0								
	204		80.0								
	205		93.0								
	206		73.0								
	207		75.0								
	208		66.0								
	209		94.0								
	210		77.0								
	211		91.0								
	212		65.0								
	SYSTEM	91.0						720	715		85.0
12/77	201		53.0								
	202		93.0								
	203		94.0								
	204		81.0								
	205		89.0								
	206		95.0								
	207		93.0								
	208		83.0								
	209		62.0								
	210		82.0								
	211		90.0								
	212		92.0								
	SYSTEM	93.0						744	733		84.0
1/78	201		91.0								
	202		75.0								
	203		64.0								
	204		72.0								
	205		74.0								
	206		67.0								
	207		91.0								
	208		88.0								
	209		77.0								
	210		72.0								
	211		73.0								
	212		84.0								
	SYSTEM	92.0						744	682		73.0

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 12/77 EQUIPMENT: ABSORBER
END DATE 1/78 PROBLEM: NOT DEFINED/SPECIFIED

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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-----------------------------------------PERFORMANCE DATA--------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------
                           THE REPLACEMENT OF STRAINER SCREENS WAS BEGUN ON DECEMBER 21.  IT TAKES
                           4-6 DAYS FOR WORK ON EACH MODULE.
              AFFECTED MODULES: SYSTEM

 2/78  201                      83.0
       202                      85.0
       203                      55.0
       204                      91.0
       205                      89.0
       206                      76.0
       207                      71.0
       208                      89.0
       209                      85.0
       210                      81.0
       211                      97.0
       212                      60.0
       SYSTEM      92.0                                                      672   620          77.0

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    2/78      EQUIPMENT: ABSORBER
              END DATE      2/78      PROBLEM: NOT DEFINED/SPECIFIED
                           STRAINER MODIFICATIONS WERE PERFORMED ON MODULES 203 AND 212.
              AFFECTED MODULES: 203     212

 3/78  201                      82.0
       202                      92.0
       203                      90.0
       204                      83.0
       205                      78.0
       206                      85.0
       207                      91.0
       208                      62.0
       209                      83.0
       210                      78.0
       211                      88.0
       212                      89.0
       SYSTEM      97.0                                                      744   744          92.0

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    3/78      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE      3/78      COMMENTS:
                           THE UNIT GENERATED MAXIMUM MEGAWATT-HOURS AND THE FGD SYSTEM TIED THE
                           HIGHEST RECORDED AVAILABILITY OF 97 PERCENT.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    4/78      EQUIPMENT: ABSORBER
              END DATE      4/78      COMMENTS:
                           MODULE 201 WAS CONVERTED TO A SPRAY TOWER DURING APRIL.
              AFFECTED MODULES: 201

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    3/78      EQUIPMENT: ABSORBER
              END DATE      3/78      PROBLEM: NOT DEFINED/SPECIFIED
                           STRAINER MODIFICATIONS WERE PERFORMED ON MODULES 208 AND 210.
              AFFECTED MODULES: 208     210

 4/78  201                      70.0
       202                      82.0
       203                      90.0
       204                      84.0
       205                      91.0
       206                      83.0
       207                      84.0
       208                      86.0
       209                      78.0
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-----------------------------------------------PERFORMANCE DATA-----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
       210                    90.0
       211                    67.0
       212                    85.0
       SYSTEM      92.0                                                       720   719          85.0

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   4/77     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     5/77     COMMENTS:
                         FROM FULL SCALE STARTUP ON APRIL 1, THE SYSTEM HAS BEEN OPERATING VERY
                         WELL WITH NO MAJOR PROBLEMS ENCOUNTERED.  THE UTILITY IS MAINTAINING A
                         SCHEDULE OF NIGHTLY CLEANING ON THE SCRUBBERS.  THE CURRENT SCHEME IS SUCH
                         THAT EACH MODULE IS CLEANED AFTER 7-8 DAYS.
            AFFECTED MODULES: SYSTEM

 5/78  201                    97.0
       202                    94.0
       203                    80.0
       204                    90.0
       205                    90.0
       206                    89.0
       207                    90.0
       208                    92.0
       209                    28.0
       210                    91.0
       211                    78.0
       212                    14.0
       SYSTEM      91.0                                                       744   120          13.0

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   5/78     EQUIPMENT: ABSORBER
            END DATE     5/78     PROBLEM: NOT DEFINED/SPECIFIED
                         THERE WERE LINER FAILURES (CEILCOTE) IN MOST OF THE MODULES DURING MAY.
                         THE LINERS WERE REPAIRED BY THE CEILCOTE COMPANY AT THEIR OWN EXPENSE.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   5/78     EQUIPMENT: BOILER-RELATED
            END DATE     5/78     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                         THE UNIT WENT DOWN ON MAY 6 FOR THE FIRST YEAR BOILER AND TURBINE INSPEC-
                         TION AND WAS DOWN THE REMAINDER OF MAY.
            AFFECTED MODULES: SYSTEM

 6/78  201                    77.0
       202                    46.0
       203                    41.0
       204                    67.0
       205                    62.0
       206                    62.0
       208                    78.0
       209                    60.0
       210                    62.0
       211                    76.0
       212                    75.0
       SYSTEM      95.0                                                       720   572          64.0

 7/78  201                    87.0
       202                    89.0
       203                    62.0
       204                    93.0
       205                    90.0
       206                    64.0
       207                    86.0
       208                    67.0
       209                    64.0
       210                    81.0
       211                    73.0
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                                SECTION 3
                 DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
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----------------------------------------PERFORMANCE DATA---------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------
       212                    71.0
       SYSTEM      95.0                                                     744   697          75.0

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    7/78     EQUIPMENT: PUMP, OTHER
             END DATE      7/78     PROBLEM: NOT DEFINED/SPECIFIED
                           THE UTILITY IS EVALUATING NEW RUBBER LINED PUMPS (8000 GPM) AS POSSIBLE
                           SOLUTIONS TO THE MIST ELIMINATOR AND REHEATER PLUGGING PROBLEMS.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    7/78     EQUIPMENT: MIST ELIMINATOR
             END DATE      7/78     PROBLEM: NOT DEFINED/SPECIFIED
                           THE UTILITY IS EVALUATING NEW STAINLESS STEEL MIST ELIMINATOR WASH LANCES
                           (TO REPLACE ORIGINAL FIBERGLASS LANCES).
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    7/78     EQUIPMENT: ABSORBER
             END DATE      7/78     PROBLEM: CHEMICAL-RELATED EROSION
                           THE FGD SYSTEM HAS BEEN EXPERIENCING PRIMARY CONTACTOR WALL AND MARBLE
                           BED WEAR.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    7/78     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE      7/78     COMMENTS:
                           THE UTILITY IS PREPARING FOR THE STATE COMPLIANCE DEADLINE ON NOVEMBER 1.
                           CORRENTLY  TESTING HAS BEEN PROCEEDING ON DIFFERENT MODULES IN AN EFFORT
                           TO FINE TUNE THE SYSTEM.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    7/78     EQUIPMENT: RECYCLE TANK
             END DATE      7/78     PROBLEM: CHEMICAL-RELATED PLUGGING
                           PLUGGING PROBLEMS IN THE REHEATER HAVE BEEN MORE FREQUENT THAN NORMAL.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    7/78     EQUIPMENT: ABSORBER
             END DATE      7/78     PROBLEM: NOT DEFINED/SPECIFIED
                           THE UTILITY IS IN THE PROCESS OF REMINING THE ORIGINAL ZURN DUPLEX
                           STRAINERS AND REPLACING THEM WITH 316 SS STRAINERS.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    5/78     EQUIPMENT: ABSORBER
             END DATE      5/78     PROBLEM: NOT DEFINED/SPECIFIED
                           THE INLET SEAL STRIPS WERE REPAIRED.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    7/78     EQUIPMENT: MIST ELIMINATOR
             END DATE      7/78     PROBLEM: CHEMICAL-RELATED PLUGGING
                           PLUGGING PROBLEMS IN THE MIST ELIMINATOR HAVE BEEN MORE FREQUENT THAN
                           NORMAL.
             AFFECTED MODULES: SYSTEM

8/78   201                    88.0
       202                   100.0
       203                    48.0
       204                    79.0
       205                    81.0
       206                    72.0
       207                    64.0
       208                    87.0
```

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------------------------------------------PERFORMANCE DATA------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION % REMOVAL     PER BOILER  FGD    CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
       209                     54.0
       210                     76.0
       211                     80.0
       212                     71.0
       SYSTEM      93.0                                                      744   695         73.0

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   8/78     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     9/78     COMMENTS:
                          NO FGD RELATED OUTAGES WERE REPORTED BY THE UTILITY FOR THE AUGUST-SEP
                          TEMBER REPORT PERIOD.
             AFFECTED MODULES: SYSTEM

 9/78  201                     72.0
       202                     82.0
       203                     70.0
       204                     61.0
       205                     74.0
       206                     64.0
       207                     82.0
       208                     72.0
       209                     75.0
       210                     78.0
       211                     82.0
       212                     68.0
       SYSTEM      96.0                                                      720   720         78.0

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   9/78     EQUIPMENT: PUMP, OTHER
             END DATE     9/78     COMMENTS:
                          THE RUBBER LINED PUMPS THAT THE UTILITY WAS INVESTIGATING HAVE BEEN
                          ORDERED.  FOUR OF THE PUMPS HAVE BEEN RECEIVED AND ONE IS INSTALLED.  THE
                          OTHERS WILL BE INSTALLED AS THEY ARE RECEIVED.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   9/78     EQUIPMENT: MIST ELIMINATOR
             END DATE     9/78     PROBLEM: NOT DEFINED/SPECIFIED
                          DIFFERENT MIST ELIMINATOR SPRAY PATTERNS ARE BEING TESTED.
             AFFECTED MODULES: SYSTEM

10/78  201                     90.0
       202                     79.0
       203                     59.0
       204                     73.0
       205                     69.0
       206                     64.0
       207                     76.0
       208                     76.0
       209                     72.0
       210                     69.0
       211                     72.0
       212                     82.0
       SYSTEM      94.0                                                      744   688         72.0

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/78     EQUIPMENT: ABSORBER
             END DATE    10/78     PROBLEM: NOT DEFINED/SPECIFIED
                          DURING OCTOBER MODULE 203 EXPERIENCED STRAINER PLUGGAGE.
             AFFECTED MODULES: 203

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/78     EQUIPMENT: RECYCLE TANK
             END DATE    10/78     PROBLEM: NOT DEFINED/SPECIFIED
                          DURING OCTOBER MODULE 203 EXPERIENCED REHEATER PROBLEMS WHICH TOGETHER
                          WITH STRAINER PLUGGING CAUSED A 4 TO 5 DAY OUTAGE.
             AFFECTED MODULES: 203
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                                  SECTION 3
                 DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
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-------------------------------------------PERFORMANCE DATA-----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD    CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

11/78  201                  84.0
       202                  45.0
       203                  82.0
       204                  80.0
       205                  75.0
       206                  58.0
       207                  77.0
       208                  75.0
       209                  83.0
       210                  83.0
       211                  72.0
       212                  47.0
       SYSTEM      92.0                                                    720   472            47.0

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/78     EQUIPMENT: BOILER-RELATED
            END DATE    11/78     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                        THE LOW NOVEMBER BOILER HOURS RESULTED FROM A TURBINE INSPECTION.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/78     EQUIPMENT: PUMP, OTHER
            END DATE    11/78     COMMENT: PREVENTIVE MAINTENANCE
                        NORMAL OVERHAUL MAINTENANCE WAS PERFORMED ON THE SPRAY PUMPS OF MODULES
                        202 AND 212.
            AFFECTED MODULES: 202    212

12/78  201                  85.0
       202                  92.0
       203                  89.0
       204                  84.0
       205                  84.0
       206                  84.0
       207                  96.0
       208                  88.0
       209                  78.0
       210                  92.0
       211                  81.0
       212                  94.0
       SYSTEM                                                                744   723            77.2

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/78     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     1/79     PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                        THE PROBLEMS ENCOUNTERED WERE MAINLY WEATHER RELATED.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/78     EQUIPMENT: BOILER-RELATED
            END DATE     1/79     PROBLEM: NOT DEFINED/SPECIFIED
                        THERE WERE PROBLEMS WITH THE COAL FEEDER BELTS RESULTING IN MOVING COAL
                        FROM COAL STOCKPILES TO THE BOILER.
            AFFECTED MODULES: SYSTEM

 1/79  201                  57.0
       202                  89.0
       203                  91.0
       204                  85.0
       205                  92.0
       206                  82.0
       207                  75.0
       208                  97.9
       209                  74.0
       210                  88.0
       211                 100.0
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
	212		50.0								
	SYSTEM							744	688		69.8

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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COMPANY NAME                                   PENNSYLVANIA POWER
PLANT NAME                                     BRUCE MANSFIELD
UNIT NUMBER                                    1
CITY                                           SHIPPINGPORT
STATE                                          PENNSYLVANIA
REGULATORY CLASSIFICATION                      B
PARTICULATE EMISSION LIMITATION - NG/J           15.        (  .035 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                  258.        (  .600 LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW             2751.0
GROSS UNIT GENERATING CAPACITY - MW             917.0
NET UNIT GENERATING CAPACITY W/FGD - MW         825.0
NET UNIT GENERATING CAPACITY WO/FGD - MW        880.0
EQUIVALENT SCRUBBED CAPACITY - MW               917.0

** BOILER DATA
    SUPPLIER                                   FOSTER WHEELER
    TYPE                                       SUPERCRITICAL, PULVERIZED COAL, BALANCED DRAFT
    SERVICE LOAD                               BASE
    COMMERCIAL SERVICE DATE                     0/76
    MAXIMUM BOILER FLUE GAS FLOW - CU.M/S       1580.86      (3350000 ACFM)
    FLUE GAS TEMPERATURE - C                     140.6      ( 285 F)
    STACK HEIGHT - M                             290.       ( 950 FT)
    STACK TOP DIAMETER - M                     *******      (***** FT)

** FUEL DATA
    FUEL TYPE                                  COAL
    FUEL GRADE                                 BITUMINOUS
    AVERAGE HEAT CONTENT - KJ/KG                26749.      ( 11500 BTU/LB)
    RANGE HEAT CONTENT - BTU/LB                               11000-11950
    AVERAGE ASH CONTENT - %                       12.90
    RANGE ASH CONTENT - %                      11.5-13.5
    AVERAGE MOISTURE CONTENT - %                   7.00
    RANGE MOISTURE CONTENT - %                 5.5-8.5
    AVERAGE SULFUR CONTENT - %                     3.00
    RANGE SULFUR CONTENT - %                   1.75-3.75
    AVERAGE CHLORIDE CONTENT - %               ********
    RANGE CHLORIDE CONTENT - %                 ******
    FUEL FIRING RATE - M T/H                     301.1      (332 TPH)
    FUEL FIRING RATE - MW                      *****

** PARTICULATE SCRUBBER
    NUMBER                                      6
    TYPE                                       VARIABLE THROAT VENTURI
    SUPPLIER                                   CHEMICO
    NUMBER OF STAGES                               2
    SHELL MATERIAL                             CARBON STEEL
    LINING MATERIAL                            POLYSTER FLAKEGLASS
    INTERNAL MATERIAL                          317 SS AND SS WITH FLAKEGLASS LINING
    TYPE OF NOZZLES                            TANGENTIAL FEED [1 SET AT THROAT,1 AT BOTTOM]
    BOILER LOAD/SCRUBBER - %                     17.0
    FLUE GAS CAPACITY - CU.M/S                  263.5       ( 558333 ACFM)
    FLUE GAS TEMPERATURE - C                    140.6       (  285 F)
    LIQUID RECIRCULATION RATE - LITER/S        1386.0       (22000 GPM)
    L/G RATIO - LITER/CU.M                        5.3       (40.0 GAL/1000ACF)
    PRESSURE DROP - KPA                           5.7       (   23 IN-H2O)
    SUPERFICIAL GAS VELOCITY - M/S               61.0       (  200.0 FT/S)
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %    99.8
    SO2 INLET CONCENTRATION - PPM              3090.000
    SO2 OUTLET CONCENTRATION - PPM              930.000
    SO2 DESIGN REMOVAL EFFICIENCY - %            92.1

** FGD SYSTEM
    SALEABLE PRODUCT/THROWAWAY PRODUCT         THROWAWAY PRODUCT
    GENERAL PROCESS TYPE                       WET SCRUBBING
    PROCESS TYPE                               LIME
    PROCESS ADDITIVES                          THIOSORBIC
    SYSTEM SUPPLIER                            CHEMICO
    A-E FIRM                                   GILBERT/COMMONWEALTH ASSOCIATES
    DEVELOPMENT LEVEL                          FULL-SCALE
    NEW/RETROFIT                               NEW
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %    99.80
    SO2 DESIGN REMOVAL EFFICIENCY - %            92.10
    COMMERCIAL DATE                             6/76
    INITIAL START-UP                           12/75
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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** ABSORBER
     NUMBER                                       6
     TYPE                                        FIXED THROAT VENTURI
     INITIAL START UP                            12/75
     SUPPLIER                                    CHEMICO
     DIMENSIONS                                  34 DIA X 51.5 HIGH
     SHELL MATERIAL                              CARBON STEEL
     SHELL LINER MATERIAL                        POLYESTER FLAKEGLASS
     INTERNAL MATERIAL                           CARBON STEEL, FLAKEGLASS LINING
     NOZZLE TYPE                                 TANGENTIAL FEED
     BOILER LOAD/ABSORBER - %                      17.0
     GAS FLOW - CU.M/S                            201.31        ( 426600 ACFM)
     GAS TEMPERATURE - C                           52.8         (  127 F)
     LIQUID RECIRCULATION RATE - LITER/S         1222.          (19400 GPM)
     L/G RATIO - L/CU.M                             6.0         ( 45.0 GAL/1000ACF)
     PRESSURE DROP - KPA                            2.0         ( 8.0 IN-H2O)
     SUPERFICAL GAS VELOCITY - M/SEC               30.5         (100.0 FT/S)
     SO2 INLET CONCENTRATION - PPM                930
     SO2 OUTLET CONTRATION - PPM                  240
     SO2 DESIGN REMOVAL EFFICIENCY - %             92.1

** FANS
     NUMBER                                       6
     TYPE                                        I.D.
     CONSTRUCTION MATERIALS                      HOUSING-RUBBER LINED C.S.; BLADES-INCONEL 625
     SERVICE - WET/DRY                           WET

** MIST ELIMINATOR
     NUMBER                                       6
     TYPE                                        CHEVRON-ABSORBER
     CONSTRUCTION MATERIAL                       FRP
     CONFIGURATION                               HORIZONTAL (2-SHAPE)
     NUMBER OF STAGES                                1
     NUMBER OF PASSES                                4
     VANE SPACING - CM                              7.6         ( 3.00 IN)
     VANE ANGLES                                 90 DEG.
     WASH SYSTEM                                 OVERSPRAY/UNDERSPRAY, ONE/SHIFT FOR OVERSPRAY, C
     SUPERFICIAL GAS VELOCITY - M/S                30.5         (100.0 FT/S)
     PRESSURE DROP - KPA                             .1         (  .3 IN-H2O)

** MIST ELIMINATOR
     NUMBER                                       6
     TYPE                                        CHEVRON-SCRUBBER
     CONSTRUCTION MATERIAL                       FRP
     CONFIGURATION                               HORIZONTAL (2-SHAPE)
     NUMBER OF STAGES                                1
     NUMBER OF PASSES                                4
     VANE SPACING - CM                              7.6         ( 3.00 IN)
     VANE ANGLES                                 90 DEG.
     WASH SYSTEM                                 OVERSPRAY/UNDERSPRAY, ONCE/SHIFT FOR OVERSPRAY.
     SUPERFICIAL GAS VELOCITY - M/S                30.5         (100.0 FT/S)
     PRESSURE DROP - KPA                             .1         (  .3 IN-H2O)

** PUMPS
     SERVICE                                     NUMBER
     -------                                     ------
     SCRUBBER RECYCLE                               6
     SCRUBBER RECYCLE (SPARE)                       6
     LIME SLURRY TRANSFER                           4
     ******                                         4
     ABSORBER RECYCLE                               6
     ABSORBER RECYCLE (SPARE)                       6
     THICKENER UNDERFLOW TO MIX TANK                4
     THICKENER TRANSFER                             4

** TANKS
     SERVICE                                     NUMBER
     -------                                     ------
     THICKENER UNDERFLOW                         ****
     MIXING TANK [CALCILOX & THCKNR UNDFL           2
     SLUDGE TRANSFER                             ****
     MIXING TANK [SPENT SLURRY & FLYASH]         ****
     RECYCLE (SCRUBBER)                             6
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    RECYCLE (ABSORBER)                             6

 ** REHEATER
    NUMBER                                        2
    TYPE                                         DIRECT COMBUSTION
    TEMPERATURE BOOST - C                           22.2        (   40 F)
    ENERGY REQUIRED                              28 BTU/H

 ** THICKENER
    NUMBER                                        1
    TYPE                                         RAKE DRIVE
    CONSTRUCTION MATERIAL                        CARBON STEEL
    DIAMETER - M                                    61.0        (200 FT)
    OUTLET SOLIDS - %                               30.0

 ** WATER LOOP
    TYPE                                         OPEN

 ** REAGENT PREPARATION EQUIPMENT
    NUMBER OF SLAKERS                               2
    SLAKER CAPACITY - M T/H                         2.0         (  2.2 TPH)

 ** TREATMENT
    TYPE                                         CALCILOX
    SUPPLIER                                     PROPRIETARY
    CONTRACTOR                                   DRAVO
    PRODUCT CHARACTERISTICS                      CONSISTENCY OF GRANULAR SOIL

 ** DISPOSAL
    NATURE                                       FINAL
    TYPE                                         LANDFILL
    LOCATION                                     OFF-SITE
    TRANSPORTATION                               PIPE
    AREA - ACRES                                  1400.0
    CAPACITY - CU.M                                59927000     ( 49000.0 ACRE-FT)


-----------------------------------------PERFORMANCE DATA-----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

12/75  A
       B
       C
       D
       E
       F
       SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/75     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    12/75     COMMENTS:
                        INITIAL OPERATION (SHAKEDOWN AND DEBUGGING) FOR PART OF THE SYSTEM COM-
                        MENCED IN DECEMBER 1975.
            AFFECTED MODULES: SYSTEM

 0/76  SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   0/76     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     0/76     COMMENTS:
                        SINCE THE UNIT COMMENCED COMMERCIAL OPERATIO IN APRIL 1976, A NUMBER OF
                        PROBLEM AREAS HAVE BEEN ENCOUNTERED, MAJOR AREAS OF CONCERN ARE SPECIFIED
                        BELOW:
                         1. EXCESSIVE MAINTENANCE PROBLEMS WITH THE WET I.D. FAN HOUSINGS.
                         2. EXCESSIVE WATER ENTRAINMENT AND CARRY OVER OUT OF THE STACK CAUSING A
                            STACK RAIN PROBLEM.
                         3. REHEAT BURNER PROBLEMS.
                         4. STACK FLUE LINER FAILURES.
            AFFECTED MODULES: SYSTEM

 1/76  SYSTEM                                                                744
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---------------------------------------PERFORMANCE DATA---------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/76     EQUIPMENT: MIST ELIMINATOR
            END DATE     1/76     PROBLEM: CHEMICAL-RELATED PLUGGING
                         THE UNIT SHUT DOWN FOR ONE WEEK DUE, IN PART, TO PLUGGED MIST ELIMINATORS.
            AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/76     EQUIPMENT: FAN
            END DATE     1/76     PROBLEM: DESIGN-RELATED VIBRATION
                         THE UNIT SHUT DOWN FOR ONE WEEK DUE, IN PART, TO I.D. FAN HOUSING VIBRA-
                         TION PROBLEMS.
            AFFECTED MODULES: SYSTEM

 2/76  SYSTEM                                                                 696

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   2/76     EQUIPMENT: REHEATER
            END DATE     2/76     PROBLEM: NOT DEFINED/SPECIFIED
                         FIRST ATTEMPTS AT STARTING UP THE REHEAT BURNERS WERE MADE THIS MONTH. SO
                         MANY PROBLEMS WERE ENCOUNTERED THAT THE VENDOR IS GOING TO REDESIGN NEW
                         REHEAT BURNERS.
            AFFECTED MODULES: SYSTEM

 3/76  SYSTEM                                                                 744

 4/76  SYSTEM                                                                 720   506

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   4/76     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     4/76     COMMENTS:
                         TOTAL OPERATING HOURS ACCUMULATED TO DATE ARE AS FOLLOWS: 0, 210, 964,
                         2147, 2808, AND 2427 FOR MODULES A THROUGH F RESPECTIVELY.  THE SCRUBBING
                         SYSTEM IS CURRENTLY HANDLING FLUE GAS AT A TOTAL EQUIVALENT CAPACITY OF
                         APPROXIMATELY 640 MW (GROSS).
            AFFECTED MODULES: SYSTEM

 5/76  A
       B
       C
       D
       E
       F
       SYSTEM       80.0       100.0       100.0        80.0                      744   595     0

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   5/76     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     5/76     COMMENTS:
                         THE LAST SCRUBBER TRAIN WAS PLACED IN SERVICE DURING THE MONTH. DURING OFF
                         PEAK HOURS ON THE WEEKENDS WHEN THE UNIT IS OPERATING AT REDUCED LOADS,
                         MAINTENANCE IS PERFORMED ON THE SHUT DOWN FGD MODULES SO THAT THEY WILL BE
                         IN OPERATING CONDITION FOR FULL LOAD OPERATION DURING THE HIGH DEMAND
                         HOURS.
            AFFECTED MODULES: SYSTEM

 6/76  A
       B
       C
       D
       E
       F
       SYSTEM      100.0       100.0       100.0       100.0                      720   720     0

      ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   6/76     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     6/76     COMMENTS:
                         THE UNIT WAS DECLARED COMMERCIALLY AVAILABLE FOR FULL LOAD OPERATION AT
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------------------------------------------PERFORMANCE DATA---------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                                825 MW (NET) ON JUNE 1, 1976.  OVER THE PERIOD A REVISED SCRUBBER BAFFLE
                                SYSTEM WAS INSTALLED IN AN EFFORT TO CORRECT THE SCRUBBER RECYCLE PUMP CA-
                                VITATION PROBLEMS.
                   AFFECTED MODULES: SYSTEM

 7/76   A
        B
        C
        D
        E
        F
        SYSTEM      90.0        100.0        100.0        90.0                        744   673      0

        ** PROBLEMS/SOLUTIONS/COMMENTS
               START DATE   7/76      EQUIPMENT: REHEATER
               END DATE     7/76      PROBLEM: NOT DEFINED/SPECIFIED
                            THE SYSTEM SUIPLIER IS STILL TRYING TO SOLVE THE REHEAT BURNER PROBLEMS.
               AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
               START DATE   7/76      EQUIPMENT: MIST ELIMINATOR
               END DATE     7/76      PROBLEM: DESIGN-RELATED UNDERSIZED COMPONENT
                            TESTS CONDUCTED THIS MONTH SHOWED THAT THE FGD SYSTEM MIST ELIMINATORS ARE
                            NOT PERFORMING TO DESIGN AND THAT THERE IS EXCESSIVE WATER ENTRAINED IN
                            THE CLEANED FLUE GASSES CAUSING A STACK RAIN PROBLEM. CHEMICO IS WORKING
                            ON THE DESIGN OF ADDITIONAL MIST ELIMINATORS THAT WILL REMOVE THIS EXCESS
                            WATER.
               AFFECTED MODULES: SYSTEM

 8/76   A
        B
        C
        D
        E
        F
        SYSTEM      95.0        100.0        100.0        95.0                        744   705      0

        ** PROBLEMS/SOLUTIONS/COMMENTS
               START DATE   8/76      EQUIPMENT: MIST ELIMINATOR
               END DATE     8/76      COMMENTS: RESEARCH AND DEVELOPMENT
                            SECONDARY VERTICAL MIST ELIMINATORS WERE INSTALLED IN THE ABSORBER DIS-
                            CHARGE DUCT IN AN ATTEMPT TO REDUCE THE EXCESSIVE ENTRAINED WATER. THEY
                            DID NOT WORK BECAUSE THE FLUE GAS BLEW THEM APART IN A FEW MINUTES OF OP-
                            ERATION.
               AFFECTED MODULES: SYSTEM

 9/76   A
        B
        C
        D
        E
        F
        SYSTEM     100.0        100.0        100.0       100.0                        720   720      0

10/76   A
        B
        C
        D
        E
        F
        SYSTEM      99.0        100.0        100.0        99.0                        744   720

11/76   A
        B
        C
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

```
------------------------------------------PERFORMANCE DATA------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ----- ----- ------
       D
       E
       F
       SYSTEM     38.0        100.0       100.0       38.0                    720   277     0

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/76     EQUIPMENT: BOILER-RELATED
            END DATE    11/76     COMMENTS:
                        A THREE WEEK OUTAGE OCCURRED DUE TO A FURNACE IMPLOSION.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/76     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    11/76     COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                        DURING THE OUTAGE SCALE THROUGHOUT THE FGD SYSTEM WAS REMOVED.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/76     EQUIPMENT: STACK
            END DATE    11/76     PROBLEM: DESIGN-RELATED INFERIOR CONSTRUCTION MATERIAL
                        DURING THE THREE WEEK OUTAGE THE UNIT 1 CHIMNEY FLUES WERE INSPECTED.  THE
                        A-SIDE FLUE POLYESTER LINING MATERIAL WAS FLAKING OFF AND ACID ATTACK WAS
                        STARTING TO CORRODE THE CARBON STEEL FLUE. THE LINING SUPPLIER IS INVESTI-
                        GATING THE PROBLEM.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/76     EQUIPMENT: MIST ELIMINATOR
            END DATE    11/76     PROBLEM: CHEMICAL-RELATED PLUGGING
                        DURING THE OUTAGE THE PLUGGED MIST ELIMINATORS WERE CLEANED.
            AFFECTED MODULES: SYSTEM

12/76  A
       B
       C
       D
       E
       F
       SYSTEM    100.0        100.0       100.0       97.0                    744   722     0

 1/77  A          95.0         98.0                   89.0
       B          92.0         91.0                   82.0
       C          77.0         74.0                   68.0
       D          95.0         98.0                   89.0
       E          92.0         97.0                   84.0
       F          91.0         91.0                   83.0
       SYSTEM                                                                 744   675

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/77     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     1/77     PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                        SEVERE WINTER WEATHER MADE OPERATION OF THE OUTDOOR FGD SYSTEM VERY DIFFI-
                        CULT AND AFFECTED THE RELIABILITY OF THE UNIT.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/77     EQUIPMENT: THICKENER
            END DATE     1/77     PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                        DURING THE FIRST PART OF THE MONTH THE THICKENER RAKE MECHANISM JAMMED AND
                        COULD NOT BE REPAIRED. THE THICKENER WAS OPERATED FOR APPROXIMATELY THREE
                        WEEKS WITH THE RAKE STOPPED UNTIL THE UNIT 2 THICKENER COULD BE PUT INTO
                        EMERGENCY SERVICE.
            AFFECTED MODULES: SYSTEM

 2/77  A          77.0         81.0                   65.0
       B          69.0         70.0                   56.0
```

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
	C	77.0	81.0		65.0						
	D	86.0	96.0		77.0						
	E	92.0	100.0		81.0						
	F	81.0	84.0		67.0						
	SYSTEM							672	540		

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 2/77 EQUIPMENT: MIST ELIMINATOR
END DATE 2/77 COMMENTS: RESEARCH AND DEVELOPMENT

A SECOND SET OF VERTICAL SECONDARY MIST ELIMINATORS WAS INSTALLED IN THE ABSORBER DISCHARGE DUCT BUT THE FLUE GAS BLEW THEM OUT BEFORE THEIR EFFICIENCY FOR REMOVING ENTRAINED WATER IN THE FLUE GAS COULD BE TESTED.

AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
3/77	A	99.0	98.0		98.0						
	B	100.0	100.0		100.0						
	C	58.0	58.0		58.0						
	D	95.0	95.0		95.0						
	E	97.0	97.0		97.0						
	F	80.0	77.0		77.0						
	SYSTEM							744	264		

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 3/77 EQUIPMENT: BOILER-RELATED
END DATE 3/77 COMMENTS:

AT 0000 MARCH 12, THE UNIT WAS SHUT DOWN FOR A 10-WEEK TURBINE OVERHAUL OUTAGE.

AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 0/ 0 EQUIPMENT: STACK
END DATE 3/77 PROBLEM: CHEMICAL-RELATED CORROSION

DURING THE MARCH OUTAGE REPAIRS WERE STARTED ON THE A-SIDE CHIMNEY FLUE WHICH WILL NOT BE COMPLETED UNTIL THE END OF AUGUST. AN INSPECTION OF THE B-SIDE CHIMNEY FLUE SHOWED THE SAME TYPE OF REPAIRS WOULD BE NEEDED, BUT WORK WILL NOT START ON THE B-SIDE UNTIL THE A-SIDE FLUE HAS BEEN REPAIRED. BECAUSE OF THESE REPAIRS THE UNIT WILL BE OPERATING AT APPROXIMATELY HALF LOAD FOR ROUGHLY ONE YEAR.

AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 3/77 EQUIPMENT: FAN
END DATE 5/77 PROBLEM: CHEMICAL-RELATED EROSION

BECAUSE OF THE EXCESSIVE MAINTENANCE REQUIRED ON THE RUBBER LINED CARBON STEEL I.D. FAN HOUSINGS FROM PIECES OF SCRUBBER SCALE DAMAGING THE LINING AND CORROSION OF THE CARBON STEEL, INCONEL PLATE WILL BE INSTALLED ON THE SCROLL AREA OF EACH OF THE SIX FANS DURING THE OUTAGE.

AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 3/77 EQUIPMENT: MIST ELIMINATOR
END DATE 5/77 COMMENTS: RESEARCH AND DEVELOPMENT

A NEWLY DESIGNED SECONDARY VERTICAL MIST ELIMINATOR WILL BE INSTALLED IN THE ABSORBER DISCHARGE DUCT OF ONE OF THE SCRUBBER MODULES DURING THE OUTAGE

AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 3/77 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 5/77 COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE

DURING THE OUTAGE ALL SCRUBBING VESSELS, DUCTS, PIPING AND MIST ELIMINATOR WILL BE CLEANED AND ALL THE SCALE REMOVED.

AFFECTED MODULES: SYSTEM

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 3/77 EQUIPMENT: PROCESS CONTROL
END DATE 5/77 PROBLEM: NOT DEFINED/SPECIFIED

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---------------------------------------------PERFORMANCE DATA----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                 SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
                      DURING OPERATION OF THE FGD SYSTEM THE PH CONTROL COULD NOT BE AUTOMATED
                      BECAUSE OF POOR DESIGN AND OPERATIONAL PROBLEMS WITH THE PROVIDED CONTROL
                      SYSTEM.  PH CONTROL WAS MANUALLY SAMPLED AND CONTROLLED OVER APPROXIMATELY
                      ONE YEAR OF OPERATION. THE PH CONTROL AND MONITORING SYSTEM ARE BEING RE-
                      VISED BY OPERATING PERSONNEL DURING THE OUTAGE IN AN EFFORT TO IMPROVE THE
                      THE PH CONTROL SYSTEM.
              AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    3/77      EQUIPMENT: REAGENT HANDLING
              END DATE      5/77      PROBLEM: CHEMICAL-RELATED CORROSION
                      THE LIME ADDITION PIPING IS BEING REVISED IN EACH OF THE SCRUBBER VESSELS
                      DUE TO THE SEVERE SCALING OCCURRING WITH THE CURRENT LIME ADDITION SYSTEM.
              AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    3/77      EQUIPMENT: MIST ELIMINATOR
              END DATE      5/77      COMMENTS: RESEARCH AND DEVELOPMENT
                      THE SYSTEM SUPPLIER IS REDESIGNING THE EXISTING MIST ELIMINATOR SPRAY PIP-
                      ING IN AN EFFORT TO CORRECT THE EXCESSIVE SCALING AND PLUGGING OF THE MIST
                      ELIMINATORS.
              AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    3/77      EQUIPMENT: PIPING
              END DATE      5/77      COMMENTS:
                      CHANGES IN FLUSH WATER AND SEAL WATER PIPING ARE BEING MADE IN AN EFFORT
                      TO CLOSE THE WATER LOOP.
              AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    3/77      EQUIPMENT: REHEATER
              END DATE      5/77      COMMENTS:
                      NEWLY MODIFIED REHEAT BURNERS WILL BE INSTALLED DURING THE OUTAGE AND
                      TESTED ON THE F-SIDE REHEATER WHEN THE UNIT STARTS UP IN MAY.
              AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    3/77      EQUIPMENT: THICKENER
              END DATE      5/77      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                      THE UNIT 1 THICKENER WAS CLEANED OUT AND THE JAMMED RAKE DRIVE MECHANISM
                      WAS REPAIRED DURING THE OUTAGE.
              AFFECTED MODULES: SYSTEM
                                                                                  720
 4/77  SYSTEM

 5/77  A
       B
       C
       D         100.0        84.0                     47.0
       E         100.0        85.0                     48.0
       F          47.0        41.0                     23.0
       SYSTEM                                                                     744

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    5/77      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE      5/77      COMMENTS:
                      THE UNIT WAS STARTED UP ON MAY 23 USING D, E, AND F MODULES DUE TO REPAIRS
                      BEING MADE TO THE A-SIDE CHIMNEY FLUE.
              AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    5/77      EQUIPMENT: REAGENT HANDLING
              END DATE      5/77      PROBLEM: NOT DEFINED/SPECIFIED
                      THERE WERE PROBLEMS SLAKING LIME AND GETTING MAGNESIUM LEVELS BUILT UP IN
                      THE SCRUBBER RECYCLE LOOPS AFTER STARTUP.
              AFFECTED MODULES: SYSTEM
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----------------------------------------PERFORMANCE DATA--------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                 SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------

 6/77   A
        B
        C
        D          94.0        100.0                    94.0
        E          95.0        100.0
        F          90.0         97.0                    90.0
        SYSTEM                                                                  720   669

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   8/77     EQUIPMENT: STACK
             END DATE     8/77     PROBLEM: NOT DEFINED/SPECIFIED
                          ON AUGUST 16 THE 1A CHIMNEY FLUE LINER REPAIRS WERE COMPLETED AND THE A, B
                          AND C TRAINS WERE STARTED UP.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   8/78     EQUIPMENT: FAN
             END DATE     8/78     PROBLEM: NOT DEFINED/SPECIFIED
                          SEVERAL REPAIRS WERE MADE TO THE ID FAN HOUSING THIS MONTH.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   8/77     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     8/77     COMMENTS:
                          THE AVERAGE SO2 REMOVAL EFFICIENCY FOR THE MONTH WAS 86.7% BASED ON THREE
                          GRAB SAMPLES.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   8/77     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     8/77     COMMENTS:
                          YORK RESEARCH BEGAN SETTING UP EQUIPMENT TO CONTINUOUSLY MONITOR THE SO2
                          REMOVAL EFFICIENCIES AS PART OF AN EPA RESEARCH PROJECT TO DETERMINE FEA-
                          SIBLE NSPS FOR FGD.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   8/77     EQUIPMENT: PROCESS CONTROL
             END DATE     8/77     COMMENTS: RESEARCH AND DEVELOPMENT
                          EXTENSIVE MODIFICATIONS ARE BEING MADE IN THE PH CONTROL SYSTEMS IN AN EF-
                          FORT TO DEVISE A WORKABLE PH CONTROL SYSTEM.
             AFFECTED MODULES: SYSTEM

 7/77   A
        B
        C
        D          99.0        100.0                    66.0
        E          99.0        100.0                    66.0
        F         100.0        100.0                    63.0
        SYSTEM                                                  83.50           744   473

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   7/77     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     7/77     COMMENTS:
                          UNIT 1 WAS DOWN FROM JULY 1 THROUGH JULY 12 TO MAKE SOME MODIFICATIONS TO
                          THE GENERATOR COOLING SYSTEM.  ON JULY 19 AND 20 PENNSYLVANIA'S DEPARTMENT
                          OF ENVIRONMENTAL RESOURCES TESTED THE SO2 AND PARTICULATE EMISSIONS FROM
                          THE UNIT 1 FGD SYSTEM.  SO2 EMISSIONS WERE 0.44 LB/MM BTU AND 1.26 LB/MM
                          BTU FOR THE TWO TESTS RESPECTIVELY.  FGD SO2 REMOVAL EFFICIENCY VARIED
                          FROM 78% TO 8[illegible]% FOR THE MONTH.
             AFFECTED MODULES: SYSTEM

 8/77   A          58.0         57.0                    52.0
        B          54.0         56.0                    50.0
        C          31.0         31.0                    28.0
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----------------------------------------PERFORMANCE DATA-----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------
       D          96.0       100.0                    93.0
       E          95.0        99.0                    93.0
       F          88.0        95.0                    85.0
       SYSTEM                                                   86.70             744    692

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/77      EQUIPMENT: BOILER-RELATED
            END DATE     8/77      COMMENTS:
                         UNIT 1 WAS DOWN FROM AUGUST 13 TO 15 BECAUSE OF BOILER TUBE LEAKS.
            AFFECTED MODULES: SYSTEM

 9/77  A          87.0        97.0                    75.0
       B          82.0        95.0                    73.0
       C          81.0        98.0                    76.0
       D          53.0        60.0                    46.0
       E          50.0        56.0                    44.0
       F          43.0        44.0                    34.0
       SYSTEM                                                   93.20             720    558

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/77      EQUIPMENT: STACK
            END DATE     9/77      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                         FROM SEPTEMBER 17 TO 22 THE UNIT WAS DOWN TO INSTALL RIGGING IN THE 1B
                         CHIMNEY FLUE TO BEGIN FLUE LINER REPAIRS.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/77      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     9/77      COMMENTS:
                         D, E AND F TRAINS WERE OFF THE REMAINDER OF THE MONTH.  THE AVERAGE SO2
                         REMOVAL EFFICIENCIES FOR THE MONTH WERE 93.2% BASED ON FOUR GRAB SAMPLE
                         TESTS.
            AFFECTED MODULES: D       E       F       SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/77      EQUIPMENT: BOILER-RELATED
            END DATE     9/77      COMMENTS:
                         A BOILER TUBE LEAK CAUSED THE UNIT TO BE DOWN SEPTEMBER 10 TO 12.
            AFFECTED MODULES: SYSTEM

10/77  A          93.0        96.0                    93.0
       B          98.0       100.0                    98.0
       C          87.0        90.0                    87.0
       D
       E
       F
       SYSTEM                                                                     744    720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/77      EQUIPMENT: MIST ELIMINATOR
            END DATE    10/77      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                         THE C-MODULE MIST ELIMINATOR SPRAY NOZZLES AND MIST ELIMINATOR ITSELF WERE
                         CLEANED.
            AFFECTED MODULES: C

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/77      EQUIPMENT: STACK
            END DATE    10/77      COMMENTS:
                         ABS STACK REPAIRS ON UNIT 2 NECESSITATED TAKING UNIT 1 DOWN FOR 2 DAYS.
                         (A PROTECTIVE CAP HAD TO BE PUT OVER THE 2B FLUE BY HELICOPTER. PREVAILING
                         WINDS NECESSITATED TAKING UNIT 1 OFF IN ORDER TO DO THIS.)
            AFFECTED MODULES: SYSTEM

11/77  A          95.0        95.0                    95.0
       B          99.0        99.0                    99.0
       C          91.0        91.0                    91.0
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-------------------------------------PERFORMANCE DATA--------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD    CAP.
                                                                SO2  PART. HOURS HOURS  HOURS  FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ -----  ------
       D
       E
       F
       SYSTEM                                                                720   720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/77      EQUIPMENT: STACK
            END DATE    11/77      COMMENTS:
                         REMOVAL OF THE OLD COATING AND PRIMING OF THE FLUE LINING IN FLUE 1B IS
                         PROCEEDING SLOWER THAN ANTICIPATED.  IT IS EXPECTED THAT TOTAL WORK ON THE
                         FLUE WILL NOT BE COMPLETED UNTIL FEBRUARY OR MARCH 1978.
            AFFECTED MODULES: SYSTEM

12/77  A          100.0        100.0                   91.0
       B           93.0         94.0                   79.0
       C           99.0        100.0                   91.0
       D
       E
       F
       SYSTEM                                                                744   626

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/77      EQUIPMENT: STACK
            END DATE    12/77      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                         SANDBLASTING OF UNIT 1B FLUE IS NEARING COMPLETION.  THE FLUE WILL BE RE-
                         LINED WITH CXL-2000.
            AFFECTED MODULES: SYSTEM

 0/78  SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   0/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     0/78      COMMENTS:
                         NOTE: AN ATTEMPT IS ALWAYS MADE TO BEGIN OPERATION OF THE BOILER AND FGD
                               SYSTEM SIMULTANEOUSLY AT BRUCE MANSFIELD.  OCCASIONALLY PROBLEMS DE-
                               LAY BOILER STARTUP MAKING IT POSSIBLE FOR MONTHLY FGD MODULE HOURS
                               TO EXCEED ACTUAL BOILER HOURS.
            AFFECTED MODULES: SYSTEM

 1/78  A          100.0        100.0                   58.0
       B
       C          100.0        100.0                   58.0
       D
       E
       F
       SYSTEM                                                                744   331

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/78      EQUIPMENT: BOILER-RELATED
            END DATE     1/78      COMMENTS:
                         THE UNIT TRIPPED SEVERAL TIMES DUE TO DIFFICULTIES IN BURNING WET STOCK-
                         PILE COAL.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/78      EQUIPMENT: FAN
            END DATE     1/78      PROBLEM: CHEMICAL-RELATED EROSION
                         THERE WERE PROBLEMS WITH THE 1B FAN WHICH NECESSITATED EXTENSIVE REPAIRS.
                         LINING ABRASION AND DISBONDMENT IN FAN CAUSED CORROSION OF UNDERLYING SUP-
                         PORT METAL.
            AFFECTED MODULES: SYSTEM

 2/78  A           79.0        100.0                   79.0
       B           61.0         80.0                   61.0
       C           82.0        100.0                   82.0
       D
```

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-----------------------------------------PERFORMANCE DATA------------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- -----  ----- ------
       E
       F
       SYSTEM                                                                 672   414

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    2/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE      2/78      COMMENTS:
                          EXTENSIVE REPAIRS TO THE 1B ID FAN AND THE EMERGENCY NEED FOR LOAD FROM
                          THE PLANT DURING THE COAL STRIKE TEMPORARILY OVERLOADED THE 1A AND 1C
                          TRAINS.
            AFFECTED MODULES: B        A        C

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    2/78      EQUIPMENT: FAN
            END DATE      2/78      PROBLEM: NOT DEFINED/SPECIFIED
                          EXTENSIVE REPAIRS TO THE 1B ID FAN WERE NECESSARY.
            AFFECTED MODULES: B

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    2/78      EQUIPMENT: MIST ELIMINATOR
            END DATE      2/78      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                          THE MIST ELIMINATOR WILL BE REPLACED ON THE 1C TRAIN AS A RESULT OF THE
                          TEMPORARY OVERLOAD THAT OCCURRED ON THE 1A AND 1C TRAIN DURING THE PERIOD.
            AFFECTED MODULES: C

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    2/78      EQUIPMENT: STACK
            END DATE      2/78      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                          THE 1B FLUE RELINING CONTINUED.
            AFFECTED MODULES: SYSTEM

 3/78  A            43.0        47.0                    43.0
       B            91.0        98.0                    91.0
       C            90.0        97.0                    90.0
       D            65.0        70.0                    65.0
       E            50.0        54.0                    50.0
       F            60.0        65.0                    60.0
       SYSTEM                                                                 744   689

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    3/78      EQUIPMENT: STACK
            END DATE      3/78      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                          REPLACEMENT OF THE LINING IN THE 1B CHIMNEY WITH CXL 2000 WAS COMPLETED.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    3/78      EQUIPMENT: FAN
            END DATE      3/78      PROBLEM: NOT DEFINED/SPECIFIED
                          REPAIRS WERE MADE ON THE A, B AND C FAN HOUSINGS.
            AFFECTED MODULES: SYSTEM

 4/78  A            74.0        74.0                    74.0
       B            88.0        88.0                    88.0
       C            49.0        49.0                    49.0
       D            87.0        87.0                    87.0
       E            97.0        97.0                    97.0
       F            94.0        94.0                    94.0
       SYSTEM                                                                 720   720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    4/78      EQUIPMENT: FAN
            END DATE      4/78      PROBLEM: NOT DEFINED/SPECIFIED
                          MISCELLANEOUS LEAK REPAIRS WERE DONE ON FAN HOUSINGS.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    4/78      EQUIPMENT: GAS DAMPER
            END DATE      4/78      PROBLEM: NOT DEFINED/SPECIFIED
```

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----------------------------------------------------------PERFORMANCE DATA-----------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------
                          MISCELLANEOUS LEAK REPAIRS WERE MADE TO DUCTS.
              AFFECTED MODULES: SYSTEM

 5/78  A           98.0        97.0                   59.0
       B
       C           98.0        97.0                   59.0
       D           91.0        85.0                   52.0
       E           92.0        84.0                   52.0
       F           92.0        86.0                   53.0
       SYSTEM                                                                744   457

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    5/78      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE      5/78      COMMENTS:
                                      THE ANNUAL BOILER INSPECTION OUTAGE BEGAN ON MAY 20.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    5/78      EQUIPMENT: FAN
              END DATE      5/78      PROBLEM: NOT DEFINED/SPECIFIED
                                      EXTENSIVE REPAIRS WERE MADE ON THE 1B FAN.
              AFFECTED MODULES: SYSTEM

 6/78  A
       B
       C          100.0
       D          100.0
       E          100.0
       F          100.0
       SYSTEM                                                                720

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    6/78      EQUIPMENT: BOILER-RELATED
              END DATE      6/78      COMMENTS:
                                      THE UNIT OUTAGE TIME WAS FOR BOILER INSPECTION AND GENERATOR STATOR COOLER
                                      REPAIRS.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    6/77      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE      6/77      COMMENTS:
                                      ALL OUTAGES EXPERIENCED BY THE UNIT THIS MONTH WERE FGD-RELATED.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    6/77      EQUIPMENT: MIST ELIMINATOR
              END DATE      6/77      PROBLEM: CHEMICAL-RELATED PLUGGING
                                      HORIZONTAL MIST ELIMINATOR PRESSURE DROPS INCREASED TO THE POINT THAT NEW
                                      MIST ELIMINATOR MODULES WERE INSTALLED ON D, E AND F SCRUBBERS AND D AND E
                                      ABSORBERS.
              AFFECTED MODULES: D      E      F

 7/78  SYSTEM                                                                744

 8/78  SYSTEM                                                                744

 9/78  SYSTEM                                                                720

10/78  SYSTEM                                                                744

11/78  SYSTEM                                                                720

12/78  SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   12/78      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE      1/79      COMMENTS:
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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-------------------------------------PERFORMANCE DATA------------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                    NO INFORMATION WAS AVAILABLE FOR THIS REPORT PERIOD.
           AFFECTED MODULES: SYS*

 1/79  SYSTEM                                                              744
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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COMPANY NAME                                    PENNSYLVANIA POWER
PLANT NAME                                      BRUCE MANSFIELD
UNIT NUMBER                                     2
CITY                                            SHIPPINGPORT
STATE                                           PENNSYLVANIA
REGULATORY CLASSIFICATION                       B
PARTICULATE EMISSION LIMITATION - NG/J            15.          (  .035 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                   258.          (  .600 LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW              2751.0
GROSS UNIT GENERATING CAPACITY - MW              917.0
NET UNIT GENERATING CAPACITY W/FGD - MW          825.0
NET UNIT GENERATING CAPACITY WO/FGD - MW         880.0
EQUIVALENT SCRUBBED CAPACITY - MW                917.0

** BOILER DATA
    SUPPLIER                                    FOSTER WHEELER
    TYPE                                        SUPERCRITICAL, PULVERIZED COAL, BALANCED DRAFT
    SERVICE LOAD                                BASE
    COMMERCIAL SERVICE DATE                      0/77
    MAXIMUM BOILER FLUE GAS FLOW - CU.M/S        1580.86       (3350000 ACFM)
    FLUE GAS TEMPERATURE - C                      140.6        ( 285 F)
    STACK HEIGHT - M                              290.         ( 950 FT)
    STACK TOP DIAMETER - M                      *******        (***** FT)

** FUEL DATA
    FUEL TYPE                                   COAL
    FUEL GRADE                                  BITUMINOUS
    AVERAGE HEAT CONTENT - KJ/KG                 26749.        ( 11500 BTU/LB)
    RANGE HEAT CONTENT - BTU/LB                                 11000-11950
    AVERAGE ASH CONTENT - %                         12.90
    RANGE ASH CONTENT - %                       11.5-13.5
    AVERAGE MOISTURE CONTENT - %                     7.00
    RANGE MOISTURE CONTENT - %                  5.5-8.5
    AVERAGE SULFUR CONTENT - %                       3.00
    RANGE SULFUR CONTENT - %                    1.75-3.75
    AVERAGE CHLORIDE CONTENT - %                ********
    RANGE CHLORIDE CONTENT - %                  ******
    FUEL FIRING RATE - M T/H                      301.1        (332 TPH)
    FUEL FIRING RATE - MW                       *****

** PARTICULATE SCRUBBER
    NUMBER                                       6
    TYPE                                        VARIABLE THROAT VENTURI
    SUPPLIER                                    CHEMICO
    SHELL MATERIAL                              CARBON STEEL
    LINING MATERIAL                             POLYESTER FLAKEGLASS
    INTERNAL MATERIAL                           317 SS AND SS WITH FLAKEGLASS LINING
    TYPE OF NOZZLES                             TANGENTIAL FEED [SET AT THROAT, SET AT BOTTOM]
    BOILER LOAD/SCRUBBER - %                      17.0
    FLUE GAS CAPACITY - CU.M/S                   263.5         ( 558333 ACFM)
    FLUE GAS TEMPERATURE - C                     140.6         (  285 F)
    LIQUID RECIRCULATION RATE - LITER/S         1386.0         (22000 GPM)
    L/G RATIO - LITER/CU.M                         5.3         (40.0 GAL/1000ACF)
    PRESSURE DROP - KPA                            5.7         (   23 IN-H2O)
    SUPERFICIAL GAS VELOCITY - M/S                61.0         (  200.0 FT/S)
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %     99.8
    SO2 INLET CONCENTRATION - PPM              3090.000
    SO2 OUTLET CONCENTRATION - PPM              930.000
    SO2 DESIGN REMOVAL EFFICIENCY - %             92.1

** FGD SYSTEM
    SALEABLE PRODUCT/THROWAWAY PRODUCT          THROWAWAY PRODUCT
    GENERAL PROCESS TYPE                        WET SCRUBBING
    PROCESS TYPE                                LIME
    PROCESS ADDITIVES                           THIOSORBIC
    SYSTEM SUPPLIER                             CHEMICO
    A-E FIRM                                    GILBERT/COMMONWEALTH ASSOCIATES
    DEVELOPMENT LEVEL                           FULL-SCALE
    NEW/RETROFIT                                NEW
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %      99.80
    SO2 DESIGN REMOVAL EFFICIENCY - %              92.10
    COMMERCIAL DATE                             10/77
    INITIAL START-UP                             7/77
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** ABSORBER
     NUMBER                                          6
     TYPE                                           FIXED THROAT VENTURI
     INITIAL START UP                                7/77
     SUPPLIER                                       CHEMICO
     DIMENSIONS                                     34 DIA X 51.5 HIGH
     SHELL MATERIAL                                 CARBON STEEL
     SHELL LINER MATERIAL                           POLYESTER FLAKEGLASS
     INTERNAL MATERIAL                              CARBON STEEL, FLAKEGLASS LINING
     NOZZLE TYPE                                    TANGENTIAL FEED
     BOILER LOAD/ABSORBER - %                         17.0
     GAS FLOW - CU.M/S                               201.31         ( 426600 ACFM)
     GAS TEMPERATURE - C                              52.8          (   127 F)
     LIQUID RECIRCULATION RATE - LITER/S            1222.           (19400 GPM)
     L/G RATIO - L/CU.M                                6.0          ( 45.0 GAL/1000ACF)
     PRESSURE DROP - KPA                               2.0          ( 8.0 IN-H2O)
     SUPERFICAL GAS VELOCITY - M/SEC                  30.5          (100.0 FT/S)
     SO2 INLET CONCENTRATION - PPM                   930
     SO2 OUTLET CONTRATION - PPM                     240
     SO2 DESIGN REMOVAL EFFICIENCY - %                92.1

** FANS
     NUMBER                                          6
     TYPE                                           I.D.
     CONSTRUCTION MATERIALS                         HOUSING-RUBBER LINED C.S.; BLADES INCONEL 625
     SERVICE - WET/DRY                              WET

** MIST ELIMINATOR
     NUMBER                                          6
     TYPE                                           CHEVRON-ABSORBER
     CONSTRUCTION MATERIAL                          FRP
     CONFIGURATION                                  HORIZONTAL (Z-SHAPE)
     NUMBER OF STAGES                                  1
     NUMBER OF PASSES                                  4
     VANE SPACING - CM                                 7.6          ( 3.00 IN)
     VANE ANGLES                                    90 DEG.
     WASH SYSTEM                                    OVERSPRAY/UNDERSPRAY, ONE/SHIFT FOR OVERSPRAY, C
     SUPERFICIAL GAS VELOCITY - M/S                   30.5          (100.0 FT/S)
     PRESSURE DROP - KPA                                .1          (  .3 IN-H2O)

** MIST ELIMINATOR
     NUMBER                                          6
     TYPE                                           CHEVRON-SCRUBBER
     CONSTRUCTION MATERIAL                          FRP
     CONFIGURATION                                  HORIZONTAL (Z-SHAPE)
     NUMBER OF STAGES                                  1
     NUMBER OF PASSES                                  4
     VANE SPACING - CM                                 7.6          ( 3.00 IN)
     VANE ANGLES                                    90 DEG.
     WASH SYSTEM                                    OVERSPRAY/UNDERSPRAY, ONCE/SHIFT FOR OVERSPRAY,
     SUPERFICIAL GAS VELOCITY - M/S                   30.5          (100.0 FT/S)
     PRESSURE DROP - KPA                                .1          (  .3 IN-H2O)

** PROCESS CONTROL CHEMISTRY
     CONTROL VARIABLES                              PH SLURRY SOLIDS, LIQUID LEVEL, LIQUID FLOW
     CONTROL RANGE                                  PH 6.8-7.2
     CONTROL MANNER                                 AUTOMATIC
     MODE                                           FEEDBACK
     SENSOR LOCATION                                PH-RECIRCULATING LINES AND THICKENER

** PUMPS
     SERVICE                                        NUMBER
     -------                                        ------
     SCRUBBER RECYCLE                                  6
     SCRUBBER RECYCLE (SPARE)                          6
     LIME SLURRY TRANSFER                              4
     ******                                            4
     ABSORBER RECYCLE                                  6
     ABSORBER RECYCLE (SPARE)                          6
     THICKENER UNDERFLOW TO MIX TANK                   4
     THICKENER TRANSFER                                4
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** TANKS
     SERVICE                                       NUMBER
     -------                                       ------
     THICKENER UNDERFLOW                           ****
     MIXING TANK (CALCILOX & THCKNR UNDF             2
     SLUDGE TRANSFER                               ****
     MIXING TANK (SPENT SLURRY & FLYASH)           ****
     RECYCLE (SCRUBBER)                              6
     RECYCLE (ABSORBER)                              6

** REHEATER
     NUMBER                                        2
     TYPE                                          DIRECT COMBUSTION
     TEMPERATURE BOOST - C                            22.2        (   40 F)
     ENERGY REQUIRED                               28 BTU/H

** THICKENER
     NUMBER                                        1
     TYPE                                          RAKE DRIVE
     CONSTRUCTION MATERIAL                         CARBON STEEL
     DIAMETER - M                                     61.0        (200 FT)
     OUTLET SOLIDS - %                                30.0

** WATER LOOP
     TYPE                                          OPEN

** REAGENT PREPARATION EQUIPMENT
     NUMBER OF SLAKERS                                2
     SLAKER CAPACITY - M T/H                          2.0         (  2.2 TPH)

** TREATMENT
     TYPE                                          CALCILOX
     SUPPLIER                                      PROPRIETARY
     CONTRACTOR                                    DRAVO
     PRODUCT CHARACTERISTICS                       CONSISTENCY OF GRANULAR SOIL

** DISPOSAL
     NATURE                                        FINAL
     TYPE                                          LANDFILL
     LOCATION                                      OFF-SITE
     TRANSPORTATION                                PIPE
     AREA - ACRES                                   1400.0
     CAPACITY - CU.M                                599270000     (490000.0 ACRE-FT)


----------------------------------------------PERFORMANCE DATA-----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

10/77   2A        94.0        100.0                    83.0
        2B        97.0        100.0                    88.0
        2C        98.0        100.0                    87.0
        2D        63.0         61.0                    48.0
        2E        66.0         59.0                    47.0
        2F        61.0         51.0                    41.0
       SYSTEM                                                                  744   595

    ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE   10/77      EQUIPMENT: BOILER_RELATED
          END DATE     10/77      COMMENTS:
                       UNIT 2 WAS DECLARED AVAILABLE FOR COMMERCIAL OPERATION AT 825 MW ON
                       OCTOBER 1, 1977.
          AFFECTED MODULES: SYSTEM

    ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE   10/77      EQUIPMENT: FAN
          END DATE     10/77      PROBLEM: NOT DEFINED/SPECIFIED
                       THE SPRAYS IN THE 2F FAN WERE CLEANED.
          AFFECTED MODULES: 2F

    ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE   10/77      EQUIPMENT: STACK
          END DATE     10/77      PROBLEM: CHEMICAL-RELATED EROSION
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---------------------------------------PERFORMANCE DATA----------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                        REPAIRS WERE MADE TO THE 2B FLUE STACK BECAUSE OF THE PREMATURE FAILURE OF
                        SEVERAL TEST PATCHES.
              AFFECTED MODULES: 2B

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  10/77     EQUIPMENT: BOILER-RELATED
              END DATE    10/77     PROBLEM: NOT DEFINED/SPECIFIED
                        THE UNIT TRIPPED DUE TO FAULTY GENERATOR CONTROL TRANSFORMERS.
              AFFECTED MODULES: SYSTEM

11/77   2A        100.0      100.0                       83.0
        2B         96.0      100.0                       81.0
        2C         88.0       92.0                       74.0
        2D         47.0       57.0                       46.0
        2E         55.0       52.0                       42.0
        2F         47.0       42.0                       34.0
        SYSTEM                                                                  720   581

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  11/77     EQUIPMENT: BOILER-RELATED
              END DATE    11/77     PROBLEM: NOT DEFINED/SPECIFIED
                        PROBLEMS ASSOCIATED WITH THE STATION POWER TRANSFORMERS CAUSED LIMITATION
                        IN LOAD ON UNIT 2. THREE OF THE SIX STATION POWER TRANSFORMERS FOR UNIT 2
                        WERE DESTROYED.
              AFFECTED MODULES: SYSTEM

12/77   2A         74.0       77.0                       63.0
        2B         99.0      100.0                       86.0
        2C         98.0      100.0                       83.0
        2D        100.0      100.0                       86.0
        2E         89.0       85.0                       69.0
        2F         99.0       93.0                       76.0
        SYSTEM                                                                  744   607

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  12/77     EQUIPMENT: PIPING
              END DATE    12/77     PROBLEM: NOT DEFINED/SPECIFIED
                        COLD WEATHER CAUSED SOME PROBLEMS IN PROCESS PIPING.
              AFFECTED MODULES: SYSTEM

 1/78   2A         95.0       58.0                       31.0
        2B        100.0      100.0                       76.0
        2C         96.0       56.0                       29.0
        2D         94.0      100.0                       70.0
        2E         99.0      100.0                       64.0
        2F         99.0       96.0                       50.0
        SYSTEM                                                                  744   391

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   1/78     EQUIPMENT: BOILER-RELATED
              END DATE     1/78     PROBLEM: NOT DEFINED/SPECIFIED
                        THE UNIT TRIPPED SEVERAL TIMES DUE TO DIFFICULTIES IN BURNING WET STOCK-
                        PILE COAL. WHEN THE UNIT WAS ON LINE DURING THIS MONTH, THE WET COAL ALSO
                        PREVENTED FULL LOAD OPERATION OF COAL MILLS.
              AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   1/78     EQUIPMENT: BOILER-RELATED
              END DATE     1/78     PROBLEM: NOT DEFINED/SPECIFIED
                        BOILER CONTROL VALVE ("W" VALVE) PROBLEMS COMPOUNDED START-UP DIFFICULTIES
              AFFECTED MODULES: SYSTEM

 2/78   2A         84.0       46.0                       48.0
        2B         87.0       68.0                       68.0
        2C         89.0       88.0                       88.0
        2D         97.0       71.0                       71.0
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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------------------------------------------PERFORMANCE DATA--------------------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------
        2E        99.0         99.0                    99.0
        2F        78.0         78.0                    78.0
       SYSTEM                                                                672   672

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   2/78      EQUIPMENT: FAN
            END DATE     2/78      PROBLEM: NOT DEFINED/SPECIFIED
                         MANY PROBLEMS OCCURRED WITH I.D. FAN COOLERS DUE TO INCLEMENT WEATHER.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   3/78      EQUIPMENT: BOILER-RELATED
            END DATE     3/78      PROBLEM: NOT DEFINED/SPECIFIED
                         A BOILER TUBE LEAK CAUSED SEVERAL DAYS' OUTAGE.
            AFFECTED MODULES: SYSTEM

 3/78   2A       100.0        100.0                    67.0
        2B        97.0         91.0                    60.0
        2C        13.0         10.0                    13.0
        2D        95.0        100.0                    68.0
        2E        95.0         96.0                    64.0
        2F        97.0         99.0                    65.0
       SYSTEM                                                                744   494

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   3/78      EQUIPMENT: FAN
            END DATE     3/78      PROBLEM: NOT DEFINED/SPECIFIED
                         EXTENSIVE I.D. FAN HOUSING REPAIRS WERE PERFORMED ON THE 2C FAN.
            AFFECTED MODULES: 2C

 4/78   2A       100.0         82.0                    81.0
        2B       100.0         82.0                    81.0
        2C        59.0         59.0                    59.0
        2D        15.0         15.0                    15.0
        2E        14.0         14.0                    14.0
        2F        13.0         13.0                    13.0
       SYSTEM                                                                720   713

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   4/78      EQUIPMENT: STACK
            END DATE     4/78      PROBLEM: CHEMICAL-RELATED EROSION
                         CHIMNEY FLUE LINING REPAIRS ON 2B APRIL 5.
            AFFECTED MODULES: 2B

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   4/78      EQUIPMENT: FAN
            END DATE     4/78      PROBLEM: NOT DEFINED/SPECIFIED
                         EXTENSIVE REPAIRS WERE MADE ON THE 2C I.D. FAN, CAUSING IT TO BE DOWN FROM
                         MARCH 6 THROUGH APRIL 13.
            AFFECTED MODULES: 2C

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   5/78      EQUIPMENT: STACK
            END DATE     5/78      PROBLEM: CHEMICAL-RELATED EROSION
                         2B STACK LINING REPAIRS CONTINUED.
            AFFECTED MODULES: 2B

 5/78   2A       100.0        100.0                    37.0
        2B       100.0        100.0                    37.0
        2C       100.0        100.0                    37.0
        2D
        2E
        2F
       SYSTEM                                                                744   270

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   5/78      EQUIPMENT: FAN
            END DATE     5/78      PROBLEM: NOT DEFINED/SPECIFIED
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------------------------------------------PERFORMANCE DATA---------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                           THE UNIT WAS OFF-LINE FOR 3 WEEKS FOR REPAIRS TO THE 2C I.D. FAN, INCLUD-
                           ING COVERING THE HOUSING WITH INCOLOY 825.
              AFFECTED MODULES: 2C

 6/78   2A        70.0       100.0                    70.0
        2B        69.0       100.0                    69.0
        2C        66.0       100.0                    66.0
        2D
        2E
        2F
       SYSTEM                                                                720   417

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    6/78     EQUIPMENT: STACK
              END DATE      6/78     PROBLEM: CHEMICAL-RELATED EROSION
                            2B STACK LINING REPAIRS CONTINUED.
              AFFECTED MODULES: 2B

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    6/78     EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE      6/78     COMMENTS:
                            *NOTE: AN ATTEMPT IS ALWAYS MADE TO BEGIN OPERATION OF THE BOILER AND FGD
                                   SYSTEM SIMULTANEOUSLY AT BRUCE MANSFIELD. OCCASIONALLY PROBLEMS
                                   DELAY BOILER START-UP, MAKING IT POSSIBLE FOR MONTHLY FGD MODULE
                                   HOURS TO EXCEED ACTUAL BOILER HOURS.
              AFFECTED MODULES: SYSTEM

 7/78  SYSTEM                                                                744

 8/78  SYSTEM                                                                744

 9/78  SYSTEM                                                                720

10/78  SYSTEM                                                                744

11/78  SYSTEM                                                                720

12/78  SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   12/78     EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE      1/79     COMMENTS:
                            NO INFORMATION WAS AVAILABLE FOR THIS PERIOD.
              AFFECTED MODULES: SYS*

 1/79  SYSTEM                                                                744
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                                    SECTION 3
                 DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
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COMPANY NAME                                          PHILADELPHIA ELECTRIC
PLANT NAME                                            EDDYSTONE
UNIT NUMBER                                           1A
CITY                                                  EDDYSTONE
STATE                                                 PENNSYLVANIA
REGULATORY CLASSIFICATION                             D
PARTICULATE EMISSION LIMITATION - NG/J                ******          (****** LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                        ******          (****** LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW                     1395.0
GROSS UNIT GENERATING CAPACITY - MW                     120.0
NET UNIT GENERATING CAPACITY W/FGD - MW                 120.0
NET UNIT GENERATING CAPACITY WO/FGD - MW              *******
EQUIVALENT SCRUBBED CAPACITY - MW                       120.0

** BOILER DATA
    SUPPLIER                                          ******
    TYPE                                              ******
    SERVICE LOAD                                      BASE
    COMMERCIAL SERVICE DATE                           **/**
    MAXIMUM BOILER FLUE GAS FLOW - CU.M/S             ********        (******* ACFM)
    FLUE GAS TEMPERATURE - C                            157.2         ( 315 F)
    STACK HEIGHT - M                                  ******          (**** FT)
    STACK TOP DIAMETER - M                            *******         (***** FT)

** FUEL DATA
    FUEL TYPE                                         COAL
    FUEL GRADE                                        ******
    AVERAGE HEAT CONTENT - KJ/KG                       31634.         ( 13600 BTU/LB)
    RANGE HEAT CONTENT - BTU/LB                                        ******
    AVERAGE ASH CONTENT - %                               9.40
    RANGE ASH CONTENT - %                             ******
    AVERAGE MOISTURE CONTENT - %                          5.90
    RANGE MOISTURE CONTENT - %                        ******
    AVERAGE SULFUR CONTENT - %                            2.60
    RANGE SULFUR CONTENT - %                          ******
    AVERAGE CHLORIDE CONTENT - %                      ********
    RANGE CHLORIDE CONTENT - %                        ******
    FUEL FIRING RATE - M T/H                          *******         (*** TPH)
    FUEL FIRING RATE - MW                             *****

** PARTICULATE SCRUBBER
    NUMBER                                             2
    TYPE                                              VENTRI-ROD
    SUPPLIER                                          ENVIRONEERING
    NUMBER OF STAGES                                   1
    SHELL MATERIAL                                    316L SS
    BOILER LOAD/SCRUBBER - %                             25.0

** FGD SYSTEM
    SALEABLE PRODUCT/THROWAWAY PRODUCT                SALEABLE PRODUCT
    GENERAL PROCESS TYPE                              WET SCRUBBING
    PROCESS TYPE                                      MAGNESIUM OXIDE
    SYSTEM SUPPLIER                                   UNITED ENGINEERS
    DEVELOPMENT LEVEL                                 DEMONSTRATION
    NEW/RETROFIT                                      RETROFIT
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %            99.00
    SO2 DESIGN REMOVAL EFFICIENCY - %                    90.00
    COMMERCIAL DATE                                    9/75
    INITIAL START-UP                                   9/75

** ABSORBER
    NUMBER                                             1
    TYPE                                              VENTRI-ROD
    INITIAL START UP                                   9/75
    SUPPLIER                                          ENVIRONEERING
    NUMBER OF STAGES                                    2
    BOILER LOAD/ABSORBER - %                            33.3
    GAS FLOW - CU.M/S                                  126.47          ( 268000 ACFM)
    LIQUID RECIRCULATION RATE - LITER/S                843.            (13384 GPM)
    L/G RATIO - L/CU.M                                   6.5           ( 48.5 GAL/1000ACF)
    PRESSURE DROP - KPA                                  2.5           (10.0 IN-H2O)

** REHEATER
    TYPE                                              DIRECT COMBUSTION
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                                        SECTION 3
                     DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
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 ** WATER LOOP
     TYPE                                           OPEN
     FRESH MAKEUP WATER ADDITION - LITERS/S           8.3          ( 132 GPM)

 ** BYPRODUCTS
     BYPRODUCT NATURE                               SULFURIC ACID


-----------------------------------------PERFORMANCE DATA-------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                               SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

 0/74  SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   0/74      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE     0/74      COMMENTS: RESEARCH AND DEVELOPMENT
```

THE EDDYSTONE STATION OF THE PHILADELPHIA ELECTRIC CO. (PECO) IS LOCATED ON THE DELAWARE RIVER IN EDDYSTONE, PENNSYLVANIA, ABOUT 11 MILES SOUTH WEST OF THE CENTER OF PHILADELPHIA. THE PLANT IS APPROXIMATELY FIVE MILES WEST OF ONE OF THE MAIN RUNWAYS OF THE PHILADELPHIA INTERNATIONAL AIRPORT.

THE STATION HAS FOUR GENERATORS WITH A TOTAL NET GENERATING CAPACITY OF 1395 MW. UNITS 1 AND 2 BURN COAL WITH AN AVERAGE GROSS HEATING VALUE O 13,600 BTU/LB AND ASH AND SULFUR CONTENTS OF 9.4 PERCENT AND 2.6 PERCENT, RESPECTIVELY. STEAM CONDITIONS ARE 5,000 PSI AND 1150 F. THESE ARE THE HIGHEST UTILITY PLANT OPERATING PRESSURE AND TEMPERATURE CONDITIONS IN THE UNITED STATES. UNITS 1 AND 2 ARE BASE-LOAD UNITS. UNITS 3 AND 4 ARE PEAK-LOAD GENERATORS WHICH BURN NO. 6 OIL.

THERE ARE TWO FURNACES ON THE NO. 1 BOILER. EACH FURNACE WAS INSTALLED WITH PARTICULATE CONTROLS CONSISTING OF MECHANICAL COLLECTORS AND AN ELECTROSTATIC PRECIPITATOR.

THE MAGNESIUM OXIDE-BASED FLUE GAS DESULFURIZATION (FGD) SYSTEM ON BOILER NO. 1 AT THE EDDYSTONE STATION OF PHILADELPHIA ELECTRIC CO. (PECO) WAS DESIGNED AND INSTALLED BY UNITED ENGINEERS AND CONSTRUCTORS, INC., IN CO-OPERATION WITH PHILADELPHIA ELECTRIC. THE SYSTEM CONSISTS OF THREE FIRST-STAGE SCRUBBER MODULES IN PARALLEL FOR PARTICULATE CONTROL (TWO ENVIRONEERING VENTRI-ROD SYSTEMS AND ONE PEABODY-LURGI VENTURI UNIT) AND A SECOND-STAGE ENVIRONEERING ABSORBER MODULE WITH TWO VENTRI-ROD BEDS FOR SULFUR DIOXIDE REMOVAL.

THE THREE FIRST-STAGE SCRUBBERS ARE SIZED TO HANDLE ALL THE EXHAUST FROM UNIT 1 WHICH HAS A WET GENERATING CAPACITY OF 316 MW. THE SECOND-STAG ABSORBER IS SIZED TO HANDLE ONE-THIRD OF THE GAS FLOW EQUIVALENT TO APPROXIMATELY 105 MW (NET). THE SYSTEM IS DESIGNED TO REMOVE 90 PERCENT OF THE SULFUR DIOXIDE FROM BOILER STACK GAS. A GENERAL PROCESS FLOW DIAGRAM OF THE WET SCRUBBING SYSTEM IS PRESENTED IN APPENDIX B.

SCRUBBER OPERATING HISTORY

THERE WAS A BRIEF OPERATING PERIOD ON THE PARTICULATE SCRUBBERS FROM MID-NOVEMBER, 1974 TO MARCH, 1975, THAT UNCOVERED A NUMBER OF PROBLEM AREAS. DUE TO A NUMBER OF EXTENUATING CIRCUMSTANCES, PARTICULATE SCRUBBING WAS NOT RESTARTED UNTIL JULY 23, 1975, WITH ONE PARTICULATE SCRUBBING TRAI FOLLOWED BY THE OTHER TWO TRAINS, ON AUGUST 15 AND OCTOBER 2, RESPECTIVELY THE SULFUR DIOXIDE ABSORBER WAS STARTED FOR THE FIRST TIME ON OCTOBER 2, 1975. AND THE MAGNESIUM OXIDE REGENERATION FACILITY FIRST PRODUCED MAGNESIUM SULFITE FROM THE EDDYSTONE SCRUBBER ON OCTOBER 28, 1975.

THE MAGNESIUM OXIDE REGNERATION FACILITY HAS BEEN OPERATED TO PROCESS ALL MAGNESIUM SULFITE DOWNS AT THE EDDYSTONE SCRUBBER.

THE SULFUR DIOXIDE SCRUBBING SYSTEM WAS TEMPORARILY SHUT DOWN DECEMBER 31, 1975, BECAUSE THE ACID PLANT REGENERATION FACILITY AT THE OLIN CHEMICA SULFURIC ACID PLANT IN PAULSBORO, NEW JERSEY PERMANENTLY CEASED OPERATIONS THE ACID PLANT REGENERATION FACILITY WAS RELOCATED TO THE ESSEX CHEMICAL PLANT IN NEWARK, NEW JERSEY.

THE PARTICULATE AND SULFURE DIOXIDE SCRUBBING SYSTEM INSTALLED ON THE

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------------------------------------------PERFORMANCE DATA-------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
                          EDDYSTONE NO. 1 UNIT IS THE FIRST PHASE OF A TWO-PHASE PROJECT. FOLLOWING
                          SUCCESSFUL DEVELOPEMTN OF THIS SYSTEM WITH MORE CONTINUOUS OPERATION, IT
                          WILL BE INCORPORATED INTO THE DESIGN FOR THE COMPLETE SULFUR DIOXIDE
                          REMOVAL ON EDDYSTONE NO. 2 AND ONE OF THE TWO EXISTING UNITS AT THE CROMBY
                          STATION.

                              ADDITIONAL INFORMATION AND DATA CONCERNING THE OPERATION OF THE PAR-
                          TICULATE AND SULFUR DIOXIDE SCRUBBERS INSTALLED AT THIS PLANT ARE PROVIDED
                          IN THE PERFORMANCE TABLE THAT FOLLOWS.
             AFFECTED MODULES: SYSTEM

11/74  SYSTEM                                                                720

     ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  11/74     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    6/75      COMMENTS: RESEARCH AND DEVELOPMENT
                          THE SCRUBBING SYSTEM AT THIS PLANT CONSISTS OF THREE PARALLEL SCRUBBING
                          TRAINS INCORPORATING 3 WET PARTICULATE SCRUBBERS AND ONE SO2 ABSORBER
                          MODULE. THERE WAS A BRIEF OPERATING PERIOD ON THE PARTICULATE SCRUBBERS
                          FROM MID-NOVEMBER 1974 TO MARCH 1975. PROBLEMS ENCOUNTERED CENTERED AROUND
                          THE SCRUBBER BOOSTER FANS AND THE FLUE GAS AND LIQUID CONDITIONS. THE
                          B-SIDE BOOSTER FAN DEVELOPED HIGH SHAFT VIBRATION WHEN STARTED FOR THE
                          FIRST TIME. THIS PROBLEM WAS DESIGN RELATED. INVOLVING AN EXCESSIVE CLEAR-
                          ANCE AREA BETWEEN THE SHAFT AND WHEEL UB. ALSO, EXTENSIVE CORROSION
                          DEVELOPED IN THE C-SIDE PARTICULATE SCRUBBER INTERNALS. THIS WAS CAUSED BY
                          LOW SCRUBBING SOLUTION PH LEVELS AND CHLORIDE LEVELS AS HIGH AS 2000 PPM.
                          THESE CONDITIONS COUPLED WITH THE THERMAL SHOCK OF A HOT START PROCEDURE
                          CAUSED THE CORROSION. THIS PROBLEM WAS AMELIORATED BY CAUSTIC ADDITION,
                          HIGHER BLOWDOWN AND EMPLOYING A COLD START PROCEDURE. AT APPROXIMATELY THI
                          TIME, A CHECKOUT OF SO2 SYSTEM WAS CONDUCTED. BLISTERING AND PEELING OF TH
                          POLYURETHANE COATINGS WERE DETECTED AND CORRECTED BY RECOATING WITH FLAKE-
                          GLASS.
             AFFECTED MODULES: SYSTEM

12/74  SYSTEM                                                                744

 1/75  SYSTEM                                                                744

 2/75  SYSTEM                                                                672

 3/75  SYSTEM                                                                744

 4/75  SYSTEM                                                                720

 5/75  SYSTEM                                                                744

 6/75  SYSTEM                                                                720

 7/75  SYSTEM                                                                744

     ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   7/75     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     1/76     COMMENTS: RESEARCH AND DEVELOPMENT
                          THE C-SIDE PARTICULATE SCRUBBER RESTARTED ON JULY 23, 1975. THE TWO REMAIN
                          ING TRINS, B-SIDE AND A-SIDE, WERE PUT INTO OPERATION ON AUGUST 15 AND
                          OCTOBER 2, RESPECTIVELY. THE SO2 ABSORBER MODULE IN THE C-SIDE SCRUBBING
                          TRAIN WAS INITIALLY PLACED IN SERVICE OCTOBER 2, 1975. THE OLIN CHEMICAL
                          MGO REGENERATION FACILITY FIRST PROCESSED MAGNESIUM SULFITE FROM THE EDDY-
                          STONE SCRUBBER ON OCTOBER 28, 1975. THE C-SIDE PARTICULATE SCRUBBER OPERA-
                          TED A TOTAL OF 2831 HOURS THROUGH JANUARY 31, 1976, FOR AN AVAILABILTY OF
                          70 PERCENT. THE B-SIDE TRAIN HAS OPERATED A TOTAL OF 1933 HOURS THROUGH
                          JANUARY 31, 1976 FOR AN AVAILABILITY OF 55 PERCENT. THE A-SIDE TRAIN OPERA
                          TED A TOTAL OF 626 HOURS THROUGH JANUARY 31, 1976, FOR AN AVAILABILITY OF
                          24 PERCENT THE C-SIDE SO2 ABSORBER WAS IN SERVICE A TOTAL OF 556 HOURS
                          THROUGH DECEMBER 31, 197 , WITH AN AVAILABILITY OF 33 PERCENT SINCE START
                          UP. PROBLEMS ENCOUNTERED IN THE OPERATION OF THE THREE SCRUBBING TRAINS
                          INCLUDED: UNDER-DESIGNED RECIRCULATION PUMPS, MALFUNCTION OF THE FLUE GAS
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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--------------------------------------PERFORMANCE DATA------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
                          BY-PASS DAMPER DRIVE UNITS AND FAILURE OF THE DOUBLE-BRICK REFRACTORY.
                          LINING IN THE REHEAT COMBUSTION CHAMBER.
             AFFECTED MODULES: SYSTEM

 8/75  SYSTEM                                                                77 744

 9/75  SYSTEM                                                                   720

10/75  SYSTEM                                                                   744

11/75  SYSTEM                                                                   720

12/75  SYSTEM                                                                   744

 1/76  SYSTEM                                                                   744

 2/76  SYSTEM                                                                   696

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   2/76     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     5/76     COMMENTS: RESEARCH AND DEVELOPMENT
                          OPERATION OF THE SO2 SCRUBBING SYSTEM AT EDDYSTONE WAS TEMPORARILY HALTED
                          BECAUSE THE ACID PLANT REGENERATION FACILITY AT THE OLIN CHEMICAL SULFURIC
                          ACID PLANT IN PAULSBORO, NEW JERSEY PERMANENTLY CEASED OPERATIONS. THE
                          UTILITY IS NOW INVESTIGATING ALTERNATIVE REGENERATION SITES. A MINIMUM PER
                          IOD OF SIX MONTHS WILL BE REQUIRED FOR RELOCATION ONCE A CHOICE IS MADE.
                          THE UTILITY ANNOUNCED PLANS FOR RELOCATION OF THE REGENERATION FACILITY AT
                          THE ESSEX CHEMICAL PLANT IN NEWARK, NEW JERSEY.
             AFFECTED MODULES: SYSTEM

 3/76  SYSTEM                                                                   744

 4/76  SYSTEM                                                                   720

 5/76  SYSTEM                                                                   744

 6/76  SYSTEM                                                                   720

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   6/76     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     8/76     COMMENTS: RESEARCH AND DEVELOPMENT
                          RESUMPTION OF SO2 SCRUBBING OPERATIONS IS PRESENTLY SCHEDULED FOR DECEMBER
                          1976. THE RELOCATION OF THE REGENERATION FACILITY IS NOW IN PROGRESS. THE
                          PARTICULATE SCRUBBERS ARE OPERATIONAL. THE C-SIDE BOOSTER FAN HAS DEVELOPE
                          A MATERIALS FAILURE BETWEEN THE HUB AND SHAFT (IDENTICAL TO THE B-SIDE UNI
                          T MENTIONED ABOVE).
             AFFECTED MODULES: SYSTEM

 7/76  SYSTEM                                                                   744

 8/76  SYSTEM                                                                   744

 9/76  SYSTEM                                                                   720

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   9/76     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    10/76     COMMENTS: RESEARCH AND DEVELOPMENT
                          ALL THREE BOOSTER FANS HAVE NOW DEVELOPED THE MATERIALS FAILURE BETWEEN TH
                          HUB AND SHAFT (AS IDENTIFIED IN THE ABOVE FOR THE B-SIDE UNIT). THESE UNIT
                          HAVE BEEN RETURNED TO THE MANUFACTURER FOR MODIFICATIONS AND REPAIRS.
                          CURRENTLY, ONE OF THE PARTICULATE SCRUBBERS IS IN THE FLUE GAS STREAM.
                          TO DATE, ALL THREE OF THE WET PARTICULATE SCRUBBERS HAVE NOT SEEN ANY
                          APPRECIABLE SIMULTANEOUS SERVICE TIME.
             AFFECTED MODULES: SYSTEM

10/76  SYSTEM                                                                   744

11/76  SYSTEM                                                                   720
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-------------------------------------------PERFORMANCE DATA-------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                               SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/76     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    12/76     COMMENTS: RESEARCH AND DEVELOPMENT
                          MGO SCRUBBING OPERATIONS ARE NOW SCHEDULED TO RESTART IN MAY 1977. REGENER
                          -ATION FACILITY RELOCATION IS BEING COMPLETED, AND MODIFICATIONS TO THE ID
                          BOOSTER FANS CURRENTLY BEING EFFECTED CONSIST OF CONVERSION FROM A SHRINK
                          FIT TO A SLIP FIT. THESE MODIFICATIONS ARE EXPECTED TO ELIMINATE RECURRING
                          VIBRATION PROBLEMS.
            AFFECTED MODULES: SYSTEM

12/76  SYSTEM                                                               744

 1/77  SYSTEM                                                               744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/77     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     3/77     COMMENTS: RESEARCH AND DEVELOPMENT
                          THE MAGNESIUM OXIDE SCRUBBING SYSTEM AT EDDYSTONE NO. IA IS STILL SCHEDULE
                          FOR RESTART IN MAY 1977. THE START-UP OF THE NEW MAGNESIUM SULFITE REGENER
                          -ATION FACILITY AT THE ESSEX CHEMICAL PLANT AT NEWARK, N.J. IS ALSO SCHED-
                          ULED FOR MAY 1977. THE THREE PARALLEL VENTURI SCRUBBERS CONTROLLING PARTIC
                          -ULATE EMISSIONS ON EDDYSTONE NO. 1 WENT BACK INTO SERVICE IN MARCH 1977.
            AFFECTED MODULES: SYSTEM

 2/77  SYSTEM                                                               672

 3/77  SYSTEM                                                               744

 4/77  SYSTEM                                                               720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   4/77     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     5/77     COMMENTS: RESEARCH AND DEVELOPMENT
                          RESUMPTION OF MAGNESIUM OXIDE SCRUBBING OPERATIONS OCCURRED DURING THE
                          REPORT PERIOD. THE UTILITY REPORTED THAT SO2 SCRUBBING OPERATIONS WERE
                          NOT CONTINUOUS THROUGHOUT THE PERIOD. THE ABSORBER WAS IN SERVICE APPROXI-
                          MATELY 206 HOURS DURING MAY. REGENERATION OPERATIONS AT THE ESSEX FACILITY
                          WERE NOT CONDUCTED DURING THE PERIOD. PECO PLANS TO INITIATE SO2 RECOVERY
                          AND MAGOX REGENERATION OPERATIONS DURING THE MONTH OF JUNE. THE SO2 MODULE
                          CONTAINS TWO ABSORBER SECTIONS IN SERIES (EACH SECTION CONSISTING OF AN
                          ADJUSTABLE ROD DECK WITH UNDERSPRAYS). ONLY ONE OF THE ABSORBER SECTIONS I
                          BEING USED FOR SO2 REMOVAL. SO2 REMOVAL EFFICIENCY HAS NOT BEEN MEASURED.
                          MAGNESIUM OXIDE LOSSES IN THE SYSTEM (ABSORBTION AND REGENERATION) ARE
                          ESTIMATED AT 10 PERCENT.
            AFFECTED MODULES: SYSTEM

 5/77  SYSTEM                                                               744

 6/77  SYSTEM                                                               720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   6/77     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     7/77     COMMENTS: RESEARCH AND DEVELOPMENT
                          FAILURE OF MINOR ANCILLIARY EQUIPMENT CAUSED SOME SHUTDOWNS. LATER, THE
                          BOILER ITSELF WENT DOWN. OVER THIS PERIOD THE ROTARY VALVE ON THE MAG.
                          SULFITE DRIER DISCHARGE PLUGGED REPEATEDLY. ALSO THE BELTS ON THE MAX-OX.
                          PRESLAKER FAILED.
            AFFECTED MODULES: SYSTEM

 7/77  SYSTEM                                                               744

 8/77  SYSTEM                                                               744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/77     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    11/77     COMMENTS: RESEARCH AND DEVELOPMENT
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---------------------------------------PERFORMANCE DATA------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD    CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                           THE ROTARY VALVE PROBLEM APPEARS TO BE SOLVED. CUMULATIVE AVAILABILITY
                           SINCE MAY IS ESTIMATED TO BE ROUGHLY 33%. PECO REPORTED 131 HOURS OF
                           CONTINUOUS OPERATION FOR THE SCRUBBER AND THICKENER CENTRIFUGE DRYING
                           LOOP. DURING THE REPORT PERIOD THERE HAVE BEEN CONTINUAL PROBLEMS WITH
                           THE GLAND PACKING ON THE FGD SYSTEM CIRCULATION PUMPS (STUFFING BOX).
                           PECO HAS SINCE CHANGED THE GLAND CONFIGURATION. THERE ALSO WAS A PROBLEM
                           WITH HIGH SOLIDS FORMATION IN THE THICKENER. DURING THE OCTOBER-NOVEMBER
                           PERIOD THERE WAS ONE RUN WHICH LASTED APPROXIMATELY FIVE DAYS.
                           GLAND PACKING PROBLEMS PERSISTED AND MECHANICAL SEALS ARE BEING CONSIDERED
                           AS POSSIBLE ALTERNATIVES. EVEN WITH HEAT TRACING THE SEAL WATER FROZE-UP
                           CAUSING ROTAMETERS TO BURST. HIGH SOLIDS PROBLEM IN THE THICKENER IS STILL
                           A PROBLEM AREA.
              AFFECTED MODULES: SYSTEM

 9/77  SYSTEM                                                                   720

10/77  SYSTEM                                                                   744

11/77  SYSTEM                                                                   720

12/77  SYSTEM                                                                   744

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  12/77      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     1/78      COMMINTS: RESEARCH AND DEVELOPMENT
                           THE UNIT WENT DOWN DECEMBER 22 FOR A TURBINE OVERHAUL. DURING THE OUTAGE
                           MAINTENANCE AND MINOR MODIFICATIONS WILL BE MADE ON THE SCRUBBERS. THE UNI
                           IS EXPECTED TO BE BACK ON LINE THE FIRST WEEK IN MARCH. THE AVAILABILITY
                           FACTOR FOR THE OCT, NOV, AND DEC QUARTER WAS 41%. DURING THIS PERIOD SOME
                           OF THE HEAT TRACING FAILED AND OTHER PROBLEMS OCCURRED WHEN LINES FROZE AT
                           THE ACID PLANT CAUSING THE FACILITY TO BE RUN INTERMITTENTLY. THE GLAND
                           PACKING PROBLEMS  HAVE NOT YET BEEN SOLVED AND MECHANICAL SEALS ARE STILL
                           BEING CONSIDERED.
              AFFECTED MODULES: SYSTEM

 1/78  SYSTEM                                                                   744

 2/78  SYSTEM                                                                   672

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   2/78      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     3/78      COMMINTS: RESEARCH AND DEVELOPMENT
                           THE TURBINE OVERHAUL CONTINUED DURING THE REPORT PERIOD. DURING THE SHUT-
                           DOWN PERIOD IT WAS FOUND THAT SOME HIGH PRESSURE STEAM TUBES WERE CRACKED,
                           SO UNIT MAINTINANCE HAS TAKEN LONGER THAN EXPECTED. SOME MINOR FGD SYSTEM
                           MODIFICATIONS HAVE BEEN INCORPORATED IN THE COURSE OF THE SHUTDOWN PERIOD.
                           START UP IS EXPECTED IN MID-APRIL 78.
              AFFECTED MODULES: SYSTEM

 3/78  SYSTEM                                                                   744

 4/78  SYSTEM                                                                   720

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   4/78      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     5/78      COMMINTS: RESEARCH AND DEVELOPMENT
                           THE UNIT CAME BACK ON LINE JUNE 1 AFTER AN EXTENSIVE SYSTEM MODIFICATION
                           OUTAGE WHICH BEGAN DECEMBER 22. THE UNIT WAS EXPECTED BACK ON LINE IN MID-
                           APRIL, BUT THERE WAS A PROBLEM WITH A SUPER PRESSURE STEAM TURBINE.
              AFFECTED MODULES: SYSTEM

 5/78  SYSTEM                                                                   744

 6/78  SYSTEM                                                                   720

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   6/78      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     7/78      COMMINTS: RESEARCH AND DEVELOPMENT
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--------------------------------------PERFORMANCE DATA----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL  PER  BOILER  FGD   CAP.
                                                                SO2 PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
                          DURING JUNE THE FGD SYSTEM ACHIEVED A 49% OPERABILITY. OPERABILITY FOR
                          JULY WAS 51%. PROBLEMS OCCURRED THE LAST WEEK OF JUNE WITH THE MGSO3 SLURR
                          CIRCULATION PUMP WHEN THE UTILITY DISCOVERED THE RUBBER LINER WAS TORN
                          AWAY. THERE HAVE BEEN SOME PROBLEMS WITH THE MGO SECTION WHERE THE MGO
                          MIXES WITH THE SYSTEM LIQUOR. FIRE BRICK WAS REMOVED FROM THE FLUID BED
                          REACTOR CHAMBER TO REPLACE THE ACID BARRIER PLATES WHICH WERE FAILING.
                          THE FIRE BRICK WAS THEN REPLACED. THE SLOW PIECE BY PIECE PROCEDURE WAS
                          TIME CONSUMING AND ACCOUNTED FOR MOST OF THE REGENERABLE FACILTY DOWN
                          TIME (MOST OF JUNE AND JULY). MAJOR PROBLEMS WERE SOLVED ON THE REGENER-
                          ATIVE FACILITY OVER THE PERIOD RESOLTING IN IMPROVED AVAILABILITY OF THE
                          FACILITY.
             AFFECTED MODULES: SYSTEM

 7/78  SYSTEM                                                                 744

 8/78   1A                      38.0                    32.0
       SYSTEM                                                                 744   631

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   8/78     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     8/78     COMMENTS: RESEARCH AND DEVELOPMENT
                          DURING THE MONTH OF AUGUST SCRUBBER CIRCULATING PIPING PROBLEMS WERE
                          ENCOUNTERED. A BUTTERFLY CONTROL VALVE WAS NOT FULLY OPEN AND A SECTION
                          OF PIPE DOWNSTREAM AT A 90 DEGREE BEND ERODED AWAY. TO CORRECT THE PROBLEM
                          THE BUTTERFLY VALVE WAS TAKEN OUT AND REPLACED WITH A RESTRICTION ORIFACE.
                          THE CIRCULATION PUMPING RATE WAS ALSO REDUCED.
             AFFECTED MODULES: SYSTEM

 9/78   1A                      78.0                    56.0
       SYSTEM                                                                 720   516

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   9/78     EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     9/78     COMMENTS: RESEARCH AND DEVELOPMENT
                          THE UTILITY REPORTED THAT NO MAJOR PROBLEMS WERE ENCOUNTERED DURING THE
                          MONTH OF SEPTEMBER. CERTAIN MECHANICAL PROBLEMS WERE RESOLVED WHICH CAUSED
                          AN IMPROVEMENT IN THE OPERABILITY FIGURE.
             AFFECTED MODULES: SYSTEM

10/78  A                        23.0
       SYSTEM                                                                 744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/78     EQUIPMENT: REAGENT HANDLING
             END DATE    12/78     PROBLEM: NOT DEFINED/SPECIFIED
                          THE FGD SYSTEM WAS SHUT DOWN FOR AN APPRECIABLE TIME DURING THE LAST
                          QUARTER OF 1978 DUE TO MODIFICATIONS TO THE MGO SLAKING EQUIPMENT.
             AFFECTED MODULES: SYSTEM

11/78  SYSTEM                                                                 720

12/78  SYSTEM                                                                 744

 1/79  SYSTEM                                                                 744
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                                   SECTION 3
              DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
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COMPANY NAME                                    PUBLIC SERVICE OF NEW MEXICO
PLANT NAME                                      SAN JUAN
UNIT NUMBER                                     1
CITY                                            WATERFLOW
STATE                                           NEW MEXICO
REGULATORY CLASSIFICATION                       B
PARTICULATE EMISSION LIMITATION - NG/J            21.         (  .050 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                   146.         (  .340 LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW              *******
GROSS UNIT GENERATING CAPACITY - MW               361.0
NET UNIT GENERATING CAPACITY W/FGD - MW           314.0
NET UNIT GENERATING CAPACITY WO/FGD - MW        *******
EQUIVALENT SCRUBBED CAPACITY - MW                 361.0

** BOILER DATA
    SUPPLIER                                    ******
    TYPE                                        ******
    SERVICE LOAD                                BASE
    COMMERCIAL SERVICE DATE                      0/76
    MAXIMUM BOILER FLUE GAS FLOW - CU.M/S         622.44      (1319000 ACFM)
    FLUE GAS TEMPERATURE - C                      122.8       ( 253 F)
    STACK HEIGHT - M                            ******        (**** FT)
    STACK TOP DIAMETER - M                      *******       (***** FT)

** FUEL DATA
    FUEL TYPE                                   COAL
    FUEL GRADE                                  ******
    AVERAGE HEAT CONTENT - KJ/KG                 18841.       (  8100 BTU/LB)
    RANGE HEAT CONTENT - BTU/LB                                 ******
    AVERAGE ASH CONTENT - %                        22.45
    RANGE ASH CONTENT - %                       ******
    AVERAGE MOISTURE CONTENT - %                   14.82
    RANGE MOISTURE CONTENT - %                  ******
    AVERAGE SULFUR CONTENT - %                       .80
    RANGE SULFUR CONTENT - %                    ******
    AVERAGE CHLORIDE CONTENT - %                ********
    RANGE CHLORIDE CONTENT - %                  ******
    FUEL FIRING RATE - M T/H                      181.4       (200 TPH)
    FUEL FIRING RATE - MW                       *****

** ESP
    NUMBER                                       1
    TYPE                                        HOT SIDE
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %      99.8

** PARTICULATE SCRUBBER
    NUMBER                                       3
    TYPE                                        VENTURI
    SUPPLIER                                    DAVY POWERGAS
    SHELL MATERIAL                              CARBON STEEL
    LINING MATERIAL                             ACID BRICK
    FLUE GAS CAPACITY - CU.M/S                    257.2       ( 545000 ACFM)
    FLUE GAS TEMPERATURE - C                      136.1       (   277 F)
    LIQUID RECIRCULATION RATE - LITER/S           224.9       ( 3570 GPM)
    PRESSURE DROP - KPA                             3.0       (    12 IN-H2O)

** FGD SYSTEM
    SALEABLE PRODUCT/THROWAWAY PRODUCT          SALEABLE PRODUCT
    GENERAL PROCESS TYPE                        WET SCRUBBING
    PROCESS TYPE                                WELLMAN LORD
    SYSTEM SUPPLIER                             DAVY POWERGAS
    DEVELOPMENT LEVEL                           FULL-SCALE
    NEW/RETROFIT                                RETROFIT
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %      99.50
    SO2 DESIGN REMOVAL EFFICIENCY - %              85.00
    INITIAL START-UP                             4/78
    CONSTRUCTION INITIATION                      1/76

** ABSORBER
    NUMBER                                       3
    TYPE                                        SPRAY TOWER
    INITIAL START UP                             4/78
    SUPPLIER                                    DAVY POWERGAS
    NUMBER OF STAGES                                5
    SHELL MATERIAL                              CONCRETE AND 316 SS
    BOILER LOAD/ABSORBER - %                       33.0
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                                   SECTION 3
             DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
------------------------------------------------------------------------------------------
        GAS FLOW - CU.M/S                                207.16       ( 439000 ACFM)
        GAS TEMPERATURE - C                               48.9        (   120 F)
        LIQUID RECIRCULATION RATE - LITER/S               47.         (   750 GPM)
        PRESSURE DROP - KPA                                4.0        (16.0 IN-H2O)
        SUPERFICAL GAS VELOCITY - M/SEC                    3.3        ( 10.8 FT/S)
        PARTICULATE INLET LOAD - G/CU.M                     .1        (   .053 GR/SCF)
        PARTICULATE REMOVAL EFFICIENCY - %                75.0
        SO2 INLET CONCENTRATION - PPM                    700
        SO2 OUTLET CONTRATION - PPM                       70
        SO2 DESIGN REMOVAL EFFICIENCY - %                 90.0

 ** ABSORBER
        NUMBER                                          1
        TYPE                                            SPRAY TOWER (SPARE)
        INITIAL START UP                                4/78
        SUPPLIER                                        DAVY POWERGAS
        NUMBER OF STAGES                                  5
        SHELL MATERIAL                                  CONCRETE AND 316 SS
        BOILER LOAD/ABSORBER - %                          33.0
        GAS FLOW - CU.M/S                                207.16       ( 439000 ACFM)
        GAS TEMPERATURE - C                               48.9        (   120 F)
        LIQUID RECIRCULATION RATE - LITER/S               47.         (   750 GPM)
        PRESSURE DROP - KPA                                4.0        (16.0 IN-H2O)
        SUPERFICAL GAS VELOCITY - M/SEC                    3.3        ( 10.8 FT/S)
        PARTICULATE INLET LOAD - G/CU.M                     .1        (   .053 GR/SCF)
        PARTICULATE REMOVAL EFFICIENCY - %                75.0
        SO2 INLET CONCENTRATION - PPM                    700
        SO2 OUTLET CONTRATION - PPM                       70
        SO2 DESIGN REMOVAL EFFICIENCY - %                 90.0

 ** FANS
        TYPE                                            DRY FAN

 ** PUMPS
        SERVICE                                         NUMBER
        -------                                         ------
        SLURRY PUMP                                     ****
        VENTURI RECIRCULATION                           ****

 ** REHEATER
        TYPE                                            INDIRECT HOT AIR
        HEATING MEDIUM                                  STEAM
        TEMPERATURE BOOST - C                             27.8         (    50 F)

 ** WATER LOOP
        TYPE                                            CLOSED
        FRESH MAKEUP WATER ADDITION - LITERS/S            30.2         (   480 GPM)

 ** BYPRODUCTS
        BYPRODUCT NATURE                                ELEMENTAL SULFUR
        BYPRODUCT QUANTITY - M T/H                        .85          (    .94 TPH)
        DISPOSITION                                     MARKETED

 ** DISPOSAL
        NATURE                                          FINAL
        TYPE                                            ASH POND
        TRANSPORTATION                                  TRUCK
        AREA - ACRES                                      280.0


------------------------------------------PERFORMANCE DATA--------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

 4/78  SYSTEM                                                              720

    ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE   4/78     EQUIPMENT: FGD SYSTEM, GENERAL
          END DATE     4/78     COMMENTS:
                         SO2 ABSORPTION BEGAN ON APRIL 8, 1978 USING TWO OF THE FOUR CELLS.  ONE
                         THIRD OF THE FLUE GAS IS BEING BYPASSED.
          AFFECTED MODULES: SYSTEM
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------------------------------------PERFORMANCE DATA-----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD    CAP.
                                                                SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   4/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     5/78      PROBLEM: NOT DEFINED/SPECIFIED
                         THE ABSORBERS WERE DOWN FOR 28 HOURS.
            AFFECTED MODULES: SYSTEM

 5/78  SYSTEM                                                                  744

 6/78  SYSTEM                                                                  720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   6/78      EQUIPMENT: SCRUBBER
            END DATE     7/78      PROBLEM: NOT DEFINED/SPECIFIED
                         A HIGH PRESSURE DROP ACROSS THE VENTURIS PREVENTED FULL FLUE GAS THROUGH
                         THE FGD SYSTEM.
            AFFECTED MODULES: SYSTEM

 7/78  SYSTEM                                                                  744

 8/78  SYSTEM                                                                  744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/78      EQUIPMENT: SCRUBBER
            END DATE     9/78      PROBLEM: NOT DEFINED/SPECIFIED
                         THE HIGH PRESSURE DROP WAS LOWERED BY ADJUSTING INTERNAL PLUMB BOBS.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/78      EQUIPMENT: MIST ELIMINATOR
            END DATE     9/78      PROBLEM: NOT DEFINED/SPECIFIED
                         REPAIRS WERE MADE TO THE MIST ELIMINATORS WHILE THE MODULES WERE DOWN
                         DURING PLUMB BOB ADJUSTMENTS.
            AFFECTED MODULES: SYSTEM

 9/78  SYSTEM                                                                  720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/78      EQUIPMENT: BOILER-RELATED
            END DATE     9/78      PROBLEM: NOT DEFINED/SPECIFIED
                         A FIRE IN THE START-UP TRANSFORMER DUCT BANK CAUSED A TWO WEEK BOILER
                         OUTAGE.
            AFFECTED MODULES: SYSTEM

10/78  SYSTEM                                                                  744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/78      EQUIPMENT: PIPING
            END DATE    11/78      PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                         HEAT TRACING FAILURES ALLOWED LINE FREEZINGS TO OCCUR.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    11/78      COMMENTS:
                         SOME SULFUR PRODUCT HAS BEEN PRODUCED.
            AFFECTED MODULES: SYSTEM

11/78  SYSTEM                                                                  720

12/78  SYSTEM                                                                  744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     1/79      PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                         THE SYSTEM HAS BEEN RUNNING HOWEVER WEATHER RELATED PROBLEMS LIMITED
                         OPERATIONS TO 2 MODULES.
```

PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
	AFFECTED MODULES: SYSTEM										
1/79	SYSTEM							744			

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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COMPANY NAME                                      PUBLIC SERVICE OF NEW MEXICO
PLANT NAME                                        SAN JUAN
UNIT NUMBER                                       2
CITY                                              WATERFLOW
STATE                                             NEW MEXICO
REGULATORY CLASSIFICATION                         B
PARTICULATE EMISSION LIMITATION - NG/J              21.         (  .050 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                     146.         (  .340 LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW                *******
GROSS UNIT GENERATING CAPACITY - MW                350.0
NET UNIT GENERATING CAPACITY W/FGD - MW            306.0
NET UNIT GENERATING CAPACITY WO/FGD - MW          *******
EQUIVALENT SCRUBBED CAPACITY - MW                  350.0

** BOILER DATA
   SUPPLIER                                       ******
   TYPE                                           ******
   SERVICE LOAD                                   BASE
   COMMERCIAL SERVICE DATE                        **/**
   MAXIMUM BOILER FLUE GAS FLOW - CU.M/S           622.44       (1319000 ACFM)
   FLUE GAS TEMPERATURE - C                        122.8        ( 253 F)
   STACK HEIGHT - M                               ******        (**** FT)
   STACK TOP DIAMETER - M                         *******       (***** FT)

** FUEL DATA
   FUEL TYPE                                      COAL
   FUEL GRADE                                     ******
   AVERAGE HEAT CONTENT - KJ/KG                    20934.       (  9000 BTU/LB)
   RANGE HEAT CONTENT - BTU/LB                                   ******
   AVERAGE ASH CONTENT - %                          22.45
   RANGE ASH CONTENT - %                          ******
   AVERAGE MOISTURE CONTENT - %                     14.82
   RANGE MOISTURE CONTENT - %                     ******
   AVERAGE SULFUR CONTENT - %                         .80
   RANGE SULFUR CONTENT - %                       ******
   AVERAGE CHLORIDE CONTENT - %                   ********
   RANGE CHLORIDE CONTENT - %                     ******
   FUEL FIRING RATE - M T/H                        181.4        (200 TPH)
   FUEL FIRING RATE - MW                          *****

** ESP
   NUMBER                                          1
   TYPE                                           HOTSIDE
   SUPPLIER                                       WESTERN PRECIPITATION
   PARTICULATE DESIGN REMOVAL EFFICIENCY - %        99.5

** PARTICULATE SCRUBBER
   NUMBER                                          3
   TYPE                                           VENTURI
   SUPPLIER                                       DAVY POWERGAS
   SHELL MATERIAL                                 CARBON STEEL
   LINING MATERIAL                                ACID BRICK
   FLUE GAS CAPACITY - CU.M/S                      257.2        ( 545000 ACFM)
   FLUE GAS TEMPERATURE - C                        136.1        (  277 F)
   LIQUID RECIRCULATION RATE - LITER/S             224.9        ( 3570 GPM)
   PRESSURE DROP - KPA                               3.0        (    12 IN-H2O)

** FGD SYSTEM
   SALEABLE PRODUCT/THROWAWAY PRODUCT             SALEABLE PRODUCT
   GENERAL PROCESS TYPE                           WET SCRUBBING
   PROCESS TYPE                                   WELLMAN LORD
   SYSTEM SUPPLIER                                DAVY POWERGAS
   CONSTRUCTION FIRM                              STEARNS AND ROGER
   DEVELOPMENT LEVEL                              FULL-SCALE
   NEW/RETROFIT                                   RETROFIT
   PARTICULATE DESIGN REMOVAL EFFICIENCY - %        99.50
   SO2 DESIGN REMOVAL EFFICIENCY - %                85.00
   INITIAL START-UP                                8/78
   CONSTRUCTION INITIATION                         1/76

** ABSORBER
   NUMBER                                          3
   TYPE                                           SPRAY TOWERS
   SUPPLIER                                       DAVY POWERGAS
   SHELL MATERIAL                                 CONCRETE AND 316 SS
   BOILER LOAD/ABSORBER - %                         33.0
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      GAS FLOW - CU.M/S                                   207.16        ( 439000 ACFM)
      GAS TEMPERATURE - C                                  48.9         (  120 F)
      L/G RATIO - L/CU.M                                     .2         (  1.7 GAL/1000ACF)
      PRESSURE DROP - KPA                                   4.0         (16.0 IN-H2O)
      SUPERFICAL GAS VELOCITY - M/SEC                       3.3         ( 10.8 FT/S)
      PARTICULATE OUTLET LOAD- G/CU.M                        .2         (  .079 GR/SCF)
      SO2 INLET CONCENTRATION - PPM                      1200
      SO2 OUTLET CONTRATION - PPM                          85
      SO2 DESIGN REMOVAL EFFICIENCY - %                    85.0

  ** ABSORBER
      NUMBER                                              1
      TYPE                                               SPRAY TOWER (SPARE)
      SUPPLIER                                           DAVY POWERGAS
      SHELL MATERIAL                                     CONCRETE AND 316 SS
      BOILER LOAD/ABSORBER - %                             33.0
      GAS FLOW - CU.M/S                                   207.16        ( 439000 ACFM)
      GAS TEMPERATURE - C                                  48.9         (  120 F)
      L/G RATIO - L/CU.M                                     .2         (  1.7 GAL/1000ACF)
      PRESSURE DROP - KPA                                   4.0         (16.0 IN-H2O)
      SUPERFICAL GAS VELOCITY - M/SEC                       3.3         ( 10.8 FT/S)
      PARTICULATE OUTLET LOAD- G/CU.M                        .2         (  .079 GR/SCF)
      SO2 INLET CONCENTRATION - PPM                      1200
      SO2 OUTLET CONTRATION - PPM                          85
      SO2 DESIGN REMOVAL EFFICIENCY - %                    85.0

  ** FANS

  ** PUMPS
      SERVICE                                            NUMBER
      -------                                            ------
      SLURRY                                               1
      VENTURI RECIRCULATION                                1

  ** REHEATER
      NUMBER                                              1
      TYPE                                               INDIRECT HOT AIR
      HEATING MEDIUM                                     STEAM
      TEMPERATURE BOOST - C                                27.8         (   50 F)

  ** WATER LOOP
      TYPE                                               CLOSED

  ** BYPRODUCTS
      BYPRODUCT NATURE                                   ELEMENTAL SULFUR
      BYPRODUCT QUANTITY - M T/H                            2.04        (  2.25 TPH)
      DISPOSITION                                        MARKETED

  ** DISPOSAL
      NATURE                                             FINAL
      TYPE                                               ASH POND
      LOCATION                                           OFF-SITE
      AREA - ACRES                                        2800.0


--------------------------------------------PERFORMANCE DATA--------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

 8/78  SYSTEM                                                                 744

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   8/78      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE     9/78      COMMENTS:
                        INITIAL OPERATIONS BEGAN IN LATE AUGUST. ALL THREE MODULES RAN TOGETHER
                        FOR THE FIRST TIME IN EARLY SEPTEMBER.
           AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   8/78      EQUIPMENT: GAS DAMPER
           END DATE     9/78      PROBLEM: NOT DEFINED/SPECIFIED
                        PROBLEMS WERE ENCOUNTERED WITH BOOSTER FAN CONTROL DAMPER.
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------------------------------------------PERFORMANCE DATA---------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD    CAP.
                                                                SO2  PART. HOURS  HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
              AFFECTED MODULES: SYSTEM

 9/78   SYSTEM                                                               720

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   9/78      EQUIPMENT: BOILER-RELATED
              END DATE     9/78      COMMENTS:
                           A TWO WEEK BOILER OUTAGE WAS CAUSED BY A FIRE IN THE START-UP TRANSFORMER
                           DUCT BANK.
              AFFECTED MODULES: SYSTEM

10/78   SYSTEM                                                               744

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  10/78      EQUIPMENT: PIPING
              END DATE    11/78      PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                           HEAT TRACING FAILURES ALLOWED LINE FREEZING TO OCCUR.
              AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  10/78      EQUIPMENT: ESP
              END DATE    11/78      PROBLEM: NOT DEFINED/SPECIFIED
                           A TEMPORARY HIGH FLYASH LOADING WAS THE RESULT OF AN ESP MALFUNCTION.
              AFFECTED MODULES: SYSTEM

11/78   SYSTEM                                                               720

12/78   SYSTEM                                                               744

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  12/78      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     1/79      PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                           THE SYSTEM HAS BEEN RUNNING HOWEVER WEATHER RELATED PROBLEMS LIMITED
                           OPERATIONS TO 2 MODULES.
              AFFECTED MODULES: SYS*

 1/79   SYSTEM                                                               744
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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COMPANY NAME                                  SOUTH CAROLINA PUBLIC SERVICE
PLANT NAME                                    WINYAH
UNIT NUMBER                                   2
CITY                                          GEORGETOWN
STATE                                         SOUTH CAROLINA
REGULATORY CLASSIFICATION                     A
PARTICULATE EMISSION LIMITATION - NG/J        ******          (****** LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                ******          (****** LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW            *******
GROSS UNIT GENERATING CAPACITY - MW             280.0
NET UNIT GENERATING CAPACITY W/FGD - MW         258.0
NET UNIT GENERATING CAPACITY WO/FGD - MW        260.0
EQUIVALENT SCRUBBED CAPACITY - MW               140.0

** BOILER DATA
     SUPPLIER                                 BABCOCK AND WILCOX
     TYPE                                     PULVERIZED COAL
     SERVICE LOAD                             BASE
     COMMERCIAL SERVICE DATE                   0/77
     MAXIMUM BOILER FLUE GAS FLOW - CU.M/S    ********        (******* ACFM)
     FLUE GAS TEMPERATURE - C                   132.2         ( 270 F)
     STACK HEIGHT - M                         ******          (**** FT)
     STACK TOP DIAMETER - M                   *******         (***** FT)

** FUEL DATA
     FUEL TYPE                                COAL
     FUEL GRADE                               BITUMINOUS
     AVERAGE HEAT CONTENT - KJ/KG              26749.         ( 11500 BTU/LB)
     RANGE HEAT CONTENT - BTU/LB                               ******
     AVERAGE ASH CONTENT - %                      13.50
     RANGE ASH CONTENT - %                    ******
     AVERAGE MOISTURE CONTENT - %             ********
     RANGE MOISTURE CONTENT - %               6.5-7.0
     AVERAGE SULFUR CONTENT - %                    1.00
     RANGE SULFUR CONTENT - %                 1.0-1.2
     AVERAGE CHLORIDE CONTENT - %             ********
     RANGE CHLORIDE CONTENT - %               ******
     FUEL FIRING RATE - M T/H                 *******         (*** TPH)
     FUEL FIRING RATE - MW                    *****

** ESP
     NUMBER                                     1
     TYPE                                     COLD SIDE
     SUPPLIER                                 RESEARCH COTTRELL

** PARTICULATE SCRUBBER
     NUMBER                                     1
     TYPE                                     VENTURI
     FLUE GAS CAPACITY - CU.M/S                 192.1         ( 407015 ACFM)
     FLUE GAS TEMPERATURE - C                   132.2         (  270 F)
     L/G RATIO - LITER/CU.M                       1.9         (14.4 GAL/1000ACF)
     PRESSURE DROP - KPA                           .7         (    3 IN-H2O)
     SUPERFICIAL GAS VELOCITY - M/S              27.4         (   90.0 FT/S)

** FGD SYSTEM
     SALEABLE PRODUCT/THROWAWAY PRODUCT       THROWAWAY PRODUCT
     GENERAL PROCESS TYPE                     WET SCRUBBING
     PROCESS TYPE                             LIMESTONE
     SYSTEM SUPPLIER                          BABCOCK & WILCOX
     A-E FIRM                                 BURNS AND ROE
     DEVELOPMENT LEVEL                        FULL-SCALE
     NEW/RETROFIT                             NEW
     PARTICULATE DESIGN REMOVAL EFFICIENCY - %   99.40
     SO2 DESIGN REMOVAL EFFICIENCY - %           69.00
     INITIAL START-UP                          7/77

** ABSORBER
     NUMBER                                     1
     TYPE                                     TRAY TOWER
     INITIAL START UP                          7/77
     GAS FLOW - CU.M/S                          159.50        ( 338000 ACFM)
     GAS TEMPERATURE - C                         52.2         (  126 F)
     L/G RATIO - L/CU.M                           6.3         ( 47.5 GAL/1000ACF)
     PRESSURE DROP - KPA                          1.1         ( 4.5 IN-H2O)
     SUPERFICAL GAS VELOCITY - M/SEC              3.2         ( 10.5 FT/S)
     SO2 INLET CONCENTRATION - PPM              935
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     SO2 OUTLET CONTRATION - PPM                     294
     SO2 DESIGN REMOVAL EFFICIENCY - %                69.0

 ** FANS
     TYPE                                          SCRUBBER F.D. FAN

 ** PUMPS
     SERVICE                                       NUMBER
     -------                                       ------
     SLURRY                                        ****

 ** REHEATER
     TYPE                                          BYPASS

 ** THICKENER
     NUMBER                                          1
     DIAMETER - M                                     15.2        ( 50 FT)
     OUTLET SOLIDS - %                                35.0

 ** WATER LOOP
     TYPE                                          OPEN
     FRESH MAKEUP WATER ADDITION - LITERS/S            6.3        (  100 GPM)

 ** REAGENT PREPARATION EQUIPMENT
     NUMBER OF BALL MILLS                              1

 ** DISPOSAL
     NATURE                                        FINAL
     TYPE                                          UNLINED POND
     LOCATION                                      ON SITE
     TRANSPORTATION                                PIPE


---------------------------------------------PERFORMANCE DATA-------------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

 2/78  SYSTEM                                                                672

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   2/78     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     3/78     COMMENTS:
                         THE FGD SYSTEM WAS BYPASSED FOR SERVERAL DAYS TO ALLOW SYSTEM CLEANING IN
                         PREPARATION FOR TESTING BY BABCOCK AND WILCOX.
            AFFECTED MODULES: SYSTEM

 3/78  SYSTEM                                                                744

 4/78  SYSTEM                                                                720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   4/78     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     5/78     PROBLEM: CHEMICAL-RELATED SCALING
                         SOME MINOR SCALING WAS ENCOUNTERED BUT IT DID NOT CAUSE AN OUTAGE.
            AFFECTED MODULES: SYSTEM

 5/78  SYSTEM                                                                744

 6/78  SYSTEM                                                                720

 7/78  SYSTEM                                                                744   722

 8/78  SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/78     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     9/78     COMMENTS:
                         THE UTILITY REPORTED NO FORCED FGD OUTAGE.
            AFFECTED MODULES: SYSTEM

 9/78  SYSTEM                                                                720
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---------------------------------------------PERFORMANCE DATA---------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD    CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- -----  ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/78      EQUIPMENT: INSTRUMENTATION
            END DATE     9/78      COMMENTS:
                         THE SO2 ANALYZERS PERFORMED WELL DURING A CERTIFICATION TEST.
            AFFECTED MODULES: SYSTEM

10/78  SYSTEM                                                                744

11/78  SYSTEM                                                                720

12/78  SYSTEM       84.8         82.6        82.6        82.1                744   740   6110

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/78      EQUIPMENT: INSTRUMENTATION
            END DATE     1/79      PROBLEM: NOT DEFINED/SPECIFIED
                         SO2 MONITOR PROBLEMS CONTINUE.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/78      EQUIPMENT: PUMP, OTHER
            END DATE     1/79      PROBLEM: NOT DEFINED/SPECIFIED
                         AN OUTAGE WAS NECESSARY FOR ABSORBER PUMP BELT RENEWAL.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/78      EQUIPMENT: INSTRUMENTATION
            END DATE     1/79      PROBLEM: NOT DEFINED/SPECIFIED
                         FEED SLURRY FLOWMETER PROBLEMS WERE ENCOUNTERED.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/78      EQUIPMENT: REAGENT HANDLING
            END DATE     1/79      PROBLEM: NOT DEFINED/SPECIFIED
                         THE OIL PUMP FOR LIMESTONE MILL EXPERIENCED TRIPS.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/78      EQUIPMENT: REAGENT HANDLING
            END DATE     1/79      PROBLEM: PLUGGING, OTHER
                         A MINOR OUTAGE WAS CAUSED BY PLUGGING OF THE SLURRY DELIVERY LINE.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/78      EQUIPMENT: SCRUBBER
            END DATE     1/79      PROBLEM: NOT DEFINED/SPECIFIED
                         QUENCHER PROBLEMS WERE EXPERIENCED DURING DECEMBER.
            AFFECTED MODULES: SYSTEM

 1/79  SYSTEM       99.6         99.6        99.6        99.6                744   744   7420
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                                    SECTION 3
                  DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
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 COMPANY NAME                                         SOUTHERN MISSISSIPPI ELECTRIC
 PLANT NAME                                           R.D. MORROW
 UNIT NUMBER                                          1
 CITY                                                 HATTISBURG
 STATE                                                MISSISSIPPI
 REGULATORY CLASSIFICATION                            A
 PARTICULATE EMISSION LIMITATION - NG/J                 43.          (  .100 LB/MMBTU)
 SO2 EMISSION LIMITATION - NG/J                        516.          ( 1.200 LB/MMBTU)
 NET PLANT GENERATING CAPACITY - MW                    400.0
 GROSS UNIT GENERATING CAPACITY - MW                   200.0
 NET UNIT GENERATING CAPACITY W/FGD - MW               180.0
 NET UNIT GENERATING CAPACITY WO/FGD - MW             *******
 EQUIVALENT SCRUBBED CAPACITY - MW                     124.0

 ** BOILER DATA
     SUPPLIER                                         RILEY STOKER
     TYPE                                             PULVERIZED COAL
     SERVICE LOAD                                     BASE
     COMMERCIAL SERVICE DATE                           0/78
     MAXIMUM BOILER FLUE GAS FLOW - CU.M/S            ********       (******* ACFM)
     FLUE GAS TEMPERATURE - C                           132.2        ( 270 F)
     STACK HEIGHT - M                                   124.         ( 408 FT)
     STACK TOP DIAMETER - M                           *******        (***** FT)

 ** FUEL DATA
     FUEL TYPE                                        COAL
     FUEL GRADE                                       ******
     AVERAGE HEAT CONTENT - KJ/KG                      27912.        ( 12000 BTU/LB)
     RANGE HEAT CONTENT - BTU/LB                                      ******
     AVERAGE ASH CONTENT - %                              8.00
     RANGE ASH CONTENT - %                            ******
     AVERAGE MOISTURE CONTENT - %                     ********
     RANGE MOISTURE CONTENT - %                       1.
     AVERAGE SULFUR CONTENT - %                           1.00
     RANGE SULFUR CONTENT - %                         ******
     AVERAGE CHLORIDE CONTENT - %                     ********
     RANGE CHLORIDE CONTENT - %                       ******
     FUEL FIRING RATE - M T/H                         *******        (*** TPH)
     FUEL FIRING RATE - MW                            *****

 ** ESP
     NUMBER                                             1
     TYPE                                             HOT SIDE
     SUPPLIER                                         BUELL/ENVIROTECH
     PARTICULATE DESIGN REMOVAL EFFICIENCY - %          99.0

 ** FGD SYSTEM
     SALEABLE PRODUCT/THROWAWAY PRODUCT               THROWAWAY PRODUCT
     GENERAL PROCESS TYPE                             WET SCRUBBING
     PROCESS TYPE                                     LIMESTONE
     SYSTEM SUPPLIER                                  RILEY STOKER/ENVIRONEERING
     A-E FIRM                                         BURNS AND MCDONALD
     CONSTRUCTION FIRM                                RILEY STOKER
     DEVELOPMENT LEVEL                                FULL-SCALE
     NEW/RETROFIT                                     NEW
     PARTICULATE DESIGN REMOVAL EFFICIENCY - %          99.60
     SO2 DESIGN REMOVAL EFFICIENCY - %                  85.00
     INITIAL START-UP                                  8/78

 ** ABSORBER
     NUMBER                                             1
     TYPE                                             VENTURI-ROD
     INITIAL START UP                                  8/78
     SUPPLIER                                         RILEY STOKER/ENVIRONEERING
     NUMBER OF STAGES                                     7
     DIMENSIONS                                       90 X 40 X 10
     INTERNAL MATERIAL                                7 LAYERS OF STAINLESS STEEL RODS
     GAS FLOW - CU.M/S                                  192.03       ( 406940 ACFM)
     GAS TEMPERATURE - C                                132.2        (  270 F)

 ** FANS
     TYPE                                             BOILER I.D.

 ** VACUUM FILTER
     NUMBER                                             1
     OUTLET SOLIDS - %                                    60.0
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** MIST ELIMINATOR
      NUMBER                                         1
      CONFIGURATION                                  VERTICAL

** REHEATER
      TYPE                                           BYPASS

** THICKENER
      NUMBER                                         1

** WATER LOOP
      TYPE                                           CLOSED

** TREATMENT
      TYPE                                           FLYASH STABILIZED
      SUPPLIER                                       NONPROPRIETARY

** DISPOSAL
      NATURE                                         FINAL
      TYPE                                           LANDFILL
      LOCATION                                       OFF-SITE
      TRANSPORTATION                                 TRUCK


-----------------------------------------PERFORMANCE DATA-----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                               SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

 8/78  SYSTEM                                                              744

     ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE   8/78      EQUIPMENT: BOILER-RELATED
          END DATE     9/78      COMMENTS:
                    A FORCED BOILER OUTAGE OCURRED DURING THE PERIOD AS A RESULT OF BOILER
                    TUBE LEAKS.
          AFFECTED MODULES: SYSTEM

 9/78  SYSTEM                                                              720

10/78  SYSTEM                                                              744

     ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  10/78      EQUIPMENT: BOILER-RELATED
          END DATE    11/78      COMMENTS:
                    OPERATION OF THE UNIT WAS INTERMITTENT DUE TO CONTINUING BOILER TUBE
                    PROBLEMS.  THE BOILER WAS SHUT DOWN NOVEMBER 1 AS A RESULT OF BOILER TUBE
                    PROBLEMS.  RESUMPTION OF OPERATION IS SCHEDULED FOR MARCH 1979.
          AFFECTED MODULES: SYSTEM

     ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  10/78      EQUIPMENT: VALVES
          END DATE    10/78      PROBLEM: CHEMICAL-RELATED PLUGGING
                    THE FGD SYSTEM WAS BYPASSED ENTIRELY IN OCTOBER DUE TO SERIOUS CONTROL
                    VALVE PLUGGING.
          AFFECTED MODULES: SYSTEM

11/78  SYSTEM                                                              720

12/78  SYSTEM                                                              744

     ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  12/78      EQUIPMENT: FGD SYSTEM, GENERAL
          END DATE     1/79      COMMENTS:
                    THE UNIT HAS NOT YET BEEN RESTARTED SINCE ITS NOVEMBER SHUTDOWN.
          AFFECTED MODULES: SYSTEM

 1/79  SYSTEM                                                              744
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COMPANY NAME                                      SPRINGFIELD CITY UTILITIES
PLANT NAME                                        SOUTHWEST
UNIT NUMBER                                       1
CITY                                              SPRINGFIELD
STATE                                             MISSOURI
REGULATORY CLASSIFICATION                         A
PARTICULATE EMISSION LIMITATION - NG/J             43.          (  .100 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                    516.          ( 1.200 LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW                173.0
GROSS UNIT GENERATING CAPACITY - MW               194.0
NET UNIT GENERATING CAPACITY W/FGD - MW           173.0
NET UNIT GENERATING CAPACITY WO/FGD - MW          182.0
EQUIVALENT SCRUBBED CAPACITY - MW                 194.0

** BOILER DATA
    SUPPLIER                                      RILEY STOKER
    TYPE                                          PULVERIZED COAL
    SERVICE LOAD                                  BASE
    COMMERCIAL SERVICE DATE                        0/76
    MAXIMUM BOILER FLUE GAS FLOW - CU.M/S         *********     (******* ACFM)
    FLUE GAS TEMPERATURE - C                        148.9       ( 300 F)
    STACK HEIGHT - M                                117.        ( 384 FT)
    STACK TOP DIAMETER - M                        ********      (***** FT)

** FUEL DATA
    FUEL TYPE                                     COAL
    FUEL GRADE                                    BITUMINOUS
    AVERAGE HEAT CONTENT - KJ/KG                   29075.       ( 12500 BTU/LB)
    RANGE HEAT CONTENT - BTU/LB                                  ******
    AVERAGE ASH CONTENT - %                           13.00
    RANGE ASH CONTENT - %                         ******
    AVERAGE MOISTURE CONTENT - %                  *********
    RANGE MOISTURE CONTENT - %                    6-12
    AVERAGE SULFUR CONTENT - %                        3.50
    RANGE SULFUR CONTENT - %                      ******
    AVERAGE CHLORIDE CONTENT - %                       .30
    RANGE CHLORIDE CONTENT - %                    ******
    FUEL FIRING RATE - M T/H                      ********      (*** TPH)
    FUEL FIRING RATE - MW                         *****

** ESP
    NUMBER                                         1
    TYPE                                          COLD SIDE
    SUPPLIER                                      AIR CORRECTION DIVISION, UOP
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %       99.7
    FLUE GAS TEMPERATURE - C                        148.9       (  300 F)

** FGD SYSTEM
    SALEABLE PRODUCT/THROWAWAY PRODUCT            THROWAWAY PRODUCT
    GENERAL PROCESS TYPE                          WET SCRUBBING
    PROCESS TYPE                                  LIMESTONE
    SYSTEM SUPPLIER                               AIR CORRECTION DIVISION, UOP
    A-E FIRM                                      BURNS & MCDONNELL
    DEVELOPMENT LEVEL                             FULL-SCALE
    NEW/RETROFIT                                  NEW
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %       99.70
    SO2 DESIGN REMOVAL EFFICIENCY - %               80.00
    INITIAL START-UP                               4/77

** ABSORBER
    NUMBER                                         2
    TYPE                                          TCA
    INITIAL START UP                               4/77
    SUPPLIER                                      AIR CORRECTION DIVISION, UOP
    NUMBER OF STAGES                                  3
    BOILER LOAD/ABSORBER - %                        50.0
    GAS FLOW - CU.M/S                              156.91       ( 332500 ACFM)
    GAS TEMPERATURE - C                            148.9        (  300 F)
    L/G RATIO - L/CU.M                               2.1        ( 16.0 GAL/1000ACF)
    SO2 DESIGN REMOVAL EFFICIENCY - %               91.7

** FANS
    TYPE                                          BOILER I.D.
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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** VACUUM FILTER
     NUMBER                                        1
     TYPE                                          ROTARY DRUM
     OUTLET SOLIDS - %                               60.0

** MIST ELIMINATOR
     NUMBER                                        2
     TYPE                                          CHEVRON
     NUMBER OF STAGES                                2

** PROCESS CONTROL CHEMISTRY
     CONTROL VARIABLES                             PH, GAS FLOW

** THICKENER
     NUMBER                                        1

** WATER LOOP
     TYPE                                          CLOSED

** TREATMENT
     TYPE                                          NONPROPRIETARY
     PRODUCT CHARACTERISTICS                       DRY FLYASH STABILIZED

** DISPOSAL
     NATURE                                        FINAL
     TYPE                                          LANDFILL
     TRANSPORTATION                                TRUCK
     AREA - ACRES                                    10.0


-------------------------------------------PERFORMANCE DATA-----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

 0/77  SYSTEM

     ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE   0/77     EQUIPMENT: FGD SYSTEM, GENERAL
          END DATE     0/77     COMMENTS:
                     INSTALLATION OF THE LIMESTONE FGD SYSTEM WAS COMPLETED DURING THE FIRST
                     QUARTER OF 1977 (BEHIND SCHEDULE, PRIMARILY BECAUSE OF DELAYS IN ELECTRIC-
                     AL WORK).  FOLLOWING AIR/WATER TESTS AND CHECKOUT OF LIMESTONE PREPARATION
                     FACILITIES, THE FGD PLANT WAS STARTED UP IN EARLY APRIL 1977 FOR MECHANIC-
                     AL SHAKEDOWN/DEBUGGING OPERATIONS WHICH CONTINUED THROUGHOUT THE SUMMER.
                     COMPLIANCE TESTING AND CERTIFICATION OF COMMERCIAL AVAILABILITY WERE SUC-
                     CESSFULLY COMPLETED IN SEPTEMBER, JUST BEFORE A SCHEDULED 3-MONTH FALL
                     SHUTDOWN.  OPERATION OF THE SYSTEM HAS BEEN HAMPERED BY A NUMBER OF PROB-
                     LEMS: MIST ELIMINATOR PLUGGING (PIPING TO M.E. SPRAY SYSTEM HAS BEEN MOD-
                     IFICATION), CORROSION IN THE PRESATURATOR (WAS RELINED WITH PRECRETE),
                     CORROSION OF THE INLET/OUTLET GAS DAMPERS (REPLACED WITH 316SS DAMPERS),
                     AND FAILURE OF PRECRETE LINING IN THE SCRUBBER AND CEILCOTE IN THE STACK
                     (BOTH FAILURES IDENTIFIED AS APPLICATION PROBLEMS).  THE UTILITY ALSO
                     FOUND IT NECESSARY TO CHANGE THE SYSTEM'S PH CONTROL FROM 5.9 TO 5.6 TO
                     INCREASE LIMESTONE UTILIZATION AND DECREASE PLUGGING WITHIN THE SYSTEM
          AFFECTED MODULES: SYSTEM

 4/77  SYSTEM                                                                 720

 5/77  SYSTEM                                                                 744

 7/77  SYSTEM                                                                 744

 8/77  SYSTEM                                                                 744

     ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE   8/77     EQUIPMENT: FGD SYSTEM, GENERAL
          END DATE     9/77     COMMENTS:
                     THE FGD SYSTEM WAS OPERATED ROUGHLY 60 PERCENT OF THE AUGUST-SEPTEMBER
                     PERIOD.  A NEW SOURCE PERFORMANCE TEST WAS RUN DURING THE SECOND WEEK OF
                     SEPTEMBER.  LATER, THE UNIT WAS SHUT DOWN FOR THE FIRST TURBINE IN-
                     SPECTION.
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-------------------------------------------PERFORMANCE DATA-------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------
              AFFECTED MODULES: SYSTEM

 9/77  SYSTEM                                                  91.70 99.75   720

10/77  SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  10/77      EQUIPMENT: GAS DAMPER
              END DATE    11/77      PROBLEM: DESIGN-RELATED INFERIOR CONSTRUCTION MATERIAL
                          OUTLET DAMPERS WERE MODIFIED (REPLACED WITH 316L STAINLESS STEEL DAMPERS).
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  10/77      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE    11/77      COMMENTS:
                          A SCHEDULED OCTOBER-NOVEMBER OUTAGE WAS INITIATED.  THE UNIT IS SCHEDULED
                          TO START UP AGAIN IN JANUARY.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  10/77      EQUIPMENT: PRESATURATOR
              END DATE    11/77      PROBLEM: DESIGN-RELATED INFERIOR CONSTRUCTION MATERIAL
                          THE PRESATURATOR WAS RELINED WITH HI-MO (HIGH MOLYBDENUM) STEEL.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  10/77      EQUIPMENT: DUCTWORK
              END DATE    11/77      PROBLEM: DESIGN-RELATED INFERIOR CONSTRUCTION MATERIAL
                          OUTLET DUCTWORK WAS RELINED WITH CEILCOTE.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  10/77      EQUIPMENT: ABSORBER
              END DATE    11/77      PROBLEM: DESIGN-RELATED INFERIOR CONSTRUCTION MATERIAL
                          HOLLOW PACKING BALLS WERE REPLACED WITH HEAVIER WALLED PLASTIC BALLS.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  10/77      EQUIPMENT: GAS DAMPER
              END DATE    11/77      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                          LEAKING AROUND OUTLET DAMPERS WAS MINIMIZED BY SEAL-AIR FANS.
              AFFECTED MODULES: SYSTEM

11/77  SYSTEM                                                                720

12/77  SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  12/77      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     1/78      COMMENTS:
                          THE PLANT SHUTDOWN CONTINUED UNTIL JANUARY 28 WHEN THE BOILER RESTARTED.
                          THE FGD SYSTEM WAS EXPECTED TO BE PUT BACK ON LINE IN FEBRUARY 1978.
                          DURING THE OUTAGE ALL REMAINING MODIFICATIONS TO THE FGD SYSTEM WERE COM-
                          PLETED.
              AFFECTED MODULES: SYSTEM

 1/78  SYSTEM                                                                744

 2/78  SYSTEM                                                                672

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   2/78      EQUIPMENT: DUCTWORK
              END DATE     3/78      PROBLEM: DESIGN-RELATED INFERIOR CONSTRUCTION MATERIAL
                          THE ABSORBERS DID NOT OPERATE DUE TO AN EXPANSION JOINT FAILURE BETWEEN
                          THE ID FAN AND THE ABSORBERS.
              AFFECTED MODULES: SYSTEM
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

```
---------------------------------------------PERFORMANCE DATA-------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                               SO2  PART. HOURS  HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   2/78     EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     3/78     COMMENTS:
                           THE ABSORBERS ARE CURRENTLY BEING BY-PASSED.  THE FGD SYSTEM IS EXPECTED
                           TO BE BACK ON LINE BY THE END OF APRIL.
              AFFECTED MODULES: SYSTEM

 3/78  SYSTEM                                                                   744

 4/78  SYSTEM                                                                   720

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   4/78     EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     5/78     COMMENTS:
                           ONLY ONE SCRUBBER-ABSORBER MODULE IS CURRENTLY OPERATING.  THE EXPANSION
                           JOINT FAILURE MENTIONED PREVIOUSLY WAS DIRECTLY RELATED TO THS DAMPER
                           FAILURE WHICH ALLOWED THE BOILER TO CONTINUE PUMPING GAS TO THE SEALED OFF
                           FGD SYSTEM.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   4/78     EQUIPMENT: ABSORBER
              END DATE     5/78     PROBLEM: DESIGN-RELATED INFERIOR CONSTRUCTION MATERIAL
                           THE UNIT EXPERIENCED AN FRP LINER FAILURE OVER THE PERIOD.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   4/78     EQUIPMENT: PIPING
              END DATE     5/78     PROBLEM: NOT DEFINED/SPECIFIED
                           A PUMP FAILURE OCCURRED DURING THE PERIOD.
              AFFECTED MODULES: SYSTEM

 5/78  SYSTEM                                                                   744

 6/78  SYSTEM                                                                   720

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   6/78     EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     6/78     COMMENTS:
                           THE A-MODULE RAN STEADILY FOR OVER 11 DAYS.  B-MODULE WAS STILL DOWN WITH
                           EXPANSION JOINT PROBLEMS
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   6/78     EQUIPMENT: MIST ELIMINATOR
              END DATE     6/78     COMMENTS: RESEARCH AND DEVELOPMENT
                           DURING THE MONTH THE MIST ELIMINATOR WASH SYSTEM WAS ALTERED FROM A SEPAR-
                           ATE CLOSED LOOP FOR EACH MODULE TO A COMMON SYSTEM FOR BOTH MODULES.  THE
                           NEW SYSTEM TAKES SUPERNATANT FROM THE TOP OF THE THICKENER FOR MIST ELIM-
                           INATOR SPRAY.
              AFFECTED MODULES: A      B

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   6/78     EQUIPMENT: INSTRUMENTATION
              END DATE     6/78     PROBLEM: NOT DEFINED/SPECIFIED
                           INSTRUMENTATION PROBLEMS WERE ENCOUNTERED DURING THE MONTH.  PH PROBES
                           WERE LOST, THE MAG-FLOW METER FOR LIMESTONE SLURRY FAILED, AND THE AUTO-
                           MATIC GAS ANALYZERS DID NOT OPERATE PROPERLY.
              AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   6/78     EQUIPMENT: PIPING
              END DATE     6/78     PROBLEM: PLUGGING, OTHER
                           SOME PIPES PLUGGED DUE TO NEOPRENE PEELING FROM VALVES.
              AFFECTED MODULES: SYSTEM
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                                    SECTION 3
                  DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
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----------------------------------------PERFORMANCE DATA-----------------------------------------
                                                                  % REMOVAL    PER  BOILER  FGD   CAP.
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  SO2  PART.  HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ----- ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    6/78     EQUIPMENT: SLUDGE DISPOSAL
            END DATE      6/78     PROBLEM: NOT DEFINED/SPECIFIED
                                   THE SLUDGE SYSTEM EXPERIENCED SOME FILTER BELT PROBLEMS DURING THE MONTH
                                   BUT THESE WERE REPAIRED.
            AFFECTED MODULES: SYSTEM

 7/78   A           16.7         16.7         16.7         16.7
        B                                                                      744   744          68.0
        SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    7/78     EQUIPMENT: TRANSFER PUMP
            END DATE      7/78     PROBLEM: NOT DEFINED/SPECIFIED
                                   PROBLEMS WERE ENCOUNTERED WITH THE MODULE-A TRANSFER PUMPS.  NINE DAYS
                                   WERE REQUIRED TO TRACE THE ELECTRICAL-RELATED PROBLEM.
            AFFECTED MODULES: A

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    7/78     EQUIPMENT: REAGENT HANDLING
            END DATE      7/78     PROBLEM: NOT DEFINED/SPECIFIED
                                   A 17-DAY OUTAGE WAS CAUSED BY PROBLEMS WITH THE BALL MILL AIR SUPPLY WHICH
                                   RESULTED IN THE UNAVAILABILITY OF SLURRY.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    7/78     EQUIPMENT: ABSORBER
            END DATE      7/78     PROBLEM: NOT DEFINED/SPECIFIED
                                   B-MODULE WAS STILL DOWN IN JULY WHILE THE UTILITY WAITED FOR THE REPLACE-
                                   MENT EXPANSION JOINT.
            AFFECTED MODULES: B

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    7/78     EQUIPMENT: INSTRUMENTATION
            END DATE      7/78     PROBLEM: NOT DEFINED/SPECIFIED
                                   WORK WAS DONE DURING THE MONTH TO IMPROVE THE INSTRUMENTATION.  IT WAS
                                   DISCOVERED THAT MANY OF THE PROBLEMS WERE DUE TO SCALE ACCUMULATION ON THE
                                   PROBES.
            AFFECTED MODULES: SYSTEM

 8/78   A           59.0         59.0         59.0         59.0
        SYSTEM                                                                 744   744          54.9

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    8/78     EQUIPMENT: DUCTWORK
            END DATE      8/78     PROBLEM: NOT DEFINED/SPECIFIED
                                   THE B-MODULE REMAINED DOWN THROUGHOUT AUGUST BECAUSE THE REPLACEMENT EX-
                                   PANSION JOINT HAD NOT YET ARRIVED.  EXPANSION JOINT REPAIR WAS REQUIRED ON
                                   THE A-MODULE.
            AFFECTED MODULES: A      B

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    8/78     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE      8/78     COMMENTS:
                                   THERE WERE NO SCHEDULED OUTAGES.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    8/78     EQUIPMENT: THICKENER
            END DATE      8/78     PROBLEM: CHEMICAL-RELATED PLUGGING
                                   PROBLEMS WITH THE THICKENER AND PLUGGED LINES CAUSED THE A-MODULE OUTAGE
                                   TOTALING 211 HOURS.
            AFFECTED MODULES: A

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    8/78     EQUIPMENT: PIPING
            END DATE      8/78     PROBLEM: CHEMICAL-RELATED PLUGGING
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--------------------------------------------PERFORMANCE DATA------------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                         PROBLEMS WITH THE THICKENER AND PLUGGED LINES CAUSED A-MODULE OUTAGES
                         TOTALING 211 HOURS.
                 AFFECTED MODULES: A

 9/76  A            22.1        28.6        28.6        22.1
       B
       SYSTEM                                                               720   557           47.6

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/78      EQUIPMENT: DUCTWORK
            END DATE     9/78      PROBLEM: NOT DEFINED/SPECIFIED
                         CONTINUATION OF THE EXPANSION JOINT PROBLEM RESULTED IN THE B-MODULE RE-
                         MAINING DOWN THROUGHOUT THE MONTH.
            AFFECTED MODULES: B

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/78      EQUIPMENT: THICKENER
            END DATE     9/78      PROBLEM: CHEMICAL-RELATED PLUGGING
                         A-MODULE DOWN TIME WAS DUE TO PLUGGING OF THE THICKENER SLURRY MAKEUP
                         LINES AND FAILURE OF THE BALLS WITHIN THE MODULE.
            AFFECTED MODULES: A

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/78      EQUIPMENT: ABSORBER
            END DATE     9/78      PROBLEM: DESIGN-RELATED INFERIOR CONSTRUCTION MATERIAL
                         A-MODULE BALLS FAILED OVER THE PERIOD.  THE HEAVIER-WALLED PING PONG BALLS
                         THAT WERE INSTALLED DURING THE DECEMBER 1977-JANUARY 1978 PERIOD WERE RE-
                         PLASED WITH 1.25 INCH DIAMETER SOLID RUBBER BALLS DURING SEPTEMBER 1978.
            AFFECTED MODULES: A

10/78  SYSTEM                                                               744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/78      EQUIPMENT:
            END DATE    10/78      COMMENTS:
                         THE BOILER WAS DOWN FOR ASCHEDULED OUTAGE DURING THE MONTH.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/78      EQUIPMENT: ABSORBER
            END DATE    10/78      PROBLEM: DESIGN-RELATED INFERIOR CONSTRUCTION MATERIAL
                         CONSIDERABLE CLEANING OF THE A-MODULE WAS DONE AS THE LOWER TWO LEVELS OF
                         THE MODULE HAD BEGUN TO PLUG WHEN THE BALLS FAILED (SEE SEPTEMBER 1978).
            AFFECTED MODULES: A

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    10/78      COMMENTS:
                         A THOROUGH CLEANING OF THE ENTIRE FGD SYSTEM OCCURRED DURING THIS PERIOD.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/78      EQUIPMENT: PIPING
            END DATE    10/78      PROBLEM: MECHANICAL-RELATED MATERIALS FAILURE
                         A BEARING WAS REPLACED ON THE SLURRY DRAW OFF PUMP.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/78      EQUIPMENT: DUCTWORK
            END DATE    10/78      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                         THE OUTLET DUCT WAS CLEANED AND PLASITE INSTALLED.  REPAIR WAS MADE TO THE
                         BYPASS DUCT TOGGLE DUE TO METAL DETERIORATION.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/78      EQUIPMENT: AGITATOR
            END DATE    10/78      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
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----------------------------------------PERFORMANCE DATA-----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                           THE RUBBER COATING ON HOLD TANK AGITATORS AND SLURRY STORAGE TANK AGITATOR
                           WERE REPAIRED.
           AFFECTED MODULES: SYSTEM

11/78  A          75.7        64.7        64.7        64.7
       B          26.3        22.5        22.5        22.4
       SYSTEM                                                               720   716           50.5

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   11/78      EQUIPMENT: BOILER-RELATED
           END DATE     11/78      COMMENTS:
                           THE BOILER OUTAGE LASTED INTO THE FIRST PART OF NOVEMBER.
           AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   11/78      EQUIPMENT: FAN
           END DATE     11/78      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                           AN FGD OUTAGE WAS CAUSED BY A FAN BEARING FAILURE ON MODULE B.
           AFFECTED MODULES: B

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   10/78      EQUIPMENT: GAS DAMPER
           END DATE     10/78      COMMENT: PREVENTIVE MAINTENANCE
                           ALL DAMPERS WERE SERVICED, REPAIRED AND EXERCISED.
           AFFECTED MODULES: SYSTEM

12/78  A          45.2        32.9        32.9        29.7
       B          81.7        76.2        76.2        68.7
       SYSTEM                                                               744   671

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   12/78      EQUIPMENT: PIPING
           END DATE     12/78      PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                           ONCE THE SPRAY NOZZLES WERE REPLACED FROZEN LINES PREVENTED MODULE STARTUP
           AFFECTED MODULES: A

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   12/78      EQUIPMENT: PIPING
           END DATE     12/78      PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                           SEVERAL LINES BROKE OR DEVELOPED LEAKS.
           AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   12/78      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE     12/78      PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                           ALL THE MAJOR OUTAGES CAN BE ATTRIBUTED TO THE COLD WEATHER.  THE SYSTEM
                           WAS NOT DESIGNED WITH DUE REGARD TO WEATHER CONDITIONS.
           AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   12/78      EQUIPMENT:
           END DATE     12/78      PROBLEM: CHEMICAL-RELATED PLUGGING
                           NOZZLE PLUGGAGE AT THE PRESATURATOR CAUSED OUTAGE TIME ON ONE MODULE.
           AFFECTED MODULES: A

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   12/78      EQUIPMENT: INSTRUMENTATION
           END DATE     12/78      PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                           ONE OR TWO NUISANCE TRIPS WERE DUE TO FROZEN INSTRUMENTS.
           AFFECTED MODULES: SYSTEM

1/79   A
       B          42.6        47.3        47.3        29.0
       SYSTEM                                                               744   457

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    1/79      EQUIPMENT: VALVES
           END DATE      1/79      PROBLEM: WEATHER-RELATED COMPONENT FAILURE
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------------------------------------------PERFORMANCE DATA------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
------ ------ ------------ ----------- ----------- -----------  SO2  PART. HOURS HOURS  HOURS FACTOR
                 ONE MODULE EXPERIENCED MAJOR OUTAGE TIME DUE TO FROZEN VALVES. ----- ------ ----- ------
          AFFECTED MODULES: B

     ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE    1/79      EQUIPMENT: FGD SYSTEM, GENERAL
          END DATE      1/79      PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                        FROZEN VALVES AND EQUIPMENT CONTRIBUTED TO THE OUTAGES OF A MODULE.
          AFFECTED MODULES: A

     ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE    1/79      EQUIPMENT: REAGENT HANDLING
          END DATE      1/79      PROBLEM: NOT DEFINED/SPECIFIED
                        DURING THE FIRST 15 DAYS OF JANUARY THE SECOND BALL MILL WAS UNUSEABLE
                        DUE TO LACK OF AIR.  THIS CAUSED PROBLEMS IN KEEPING LIMESTONE SLURRY
                        SUPPLIED TO THE A-MODULE.
          AFFECTED MODULES: A
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                                        SECTION 3
                        DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
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 COMPANY NAME                                    TENNESSEE VALLEY AUTHORITY
 PLANT NAME                                      SHAWNEE
 UNIT NUMBER                                     10A
 CITY                                            PADUCAH
 STATE                                           KENTUCKY
 REGULATORY CLASSIFICATION                       C
 PARTICULATE EMISSION LIMITATION - NG/J            43.          (  .100 LB/MMBTU)
 SO2 EMISSION LIMITATION - NG/J                   516.          ( 1.200 LB/MMBTU)
 NET PLANT GENERATING CAPACITY - MW              1750.0
 GROSS UNIT GENERATING CAPACITY - MW               10.0
 NET UNIT GENERATING CAPACITY W/FGD - MW           10.0
 NET UNIT GENERATING CAPACITY WO/FGD - MW        *******
 EQUIVALENT SCRUBBED CAPACITY - MW                 10.0

 ** BOILER DATA
      SUPPLIER                                   ******
      TYPE                                       BASE
      SERVICE LOAD                               ******
      COMMERCIAL SERVICE DATE                    **/**
      MAXIMUM BOILER FLUE GAS FLOW - CU.M/S      *********     (******* ACFM)
      FLUE GAS TEMPERATURE - C                   *******       (**** F)
      STACK HEIGHT - M                           ******        (**** FT)
      STACK TOP DIAMETER - M                     *******       (***** FT)

 ** FUEL DATA
      FUEL TYPE                                  COAL
      FUEL GRADE                                 BITUMINOUS
      AVERAGE HEAT CONTENT - KJ/KG               *******       (****** BTU/LB)
      RANGE HEAT CONTENT - BTU/LB                               ******
      AVERAGE ASH CONTENT - %                    ********
      RANGE ASH CONTENT - %                      ******
      AVERAGE MOISTURE CONTENT - %               ********
      RANGE MOISTURE CONTENT - %                 ******
      AVERAGE SULFUR CONTENT - %                     2.90
      RANGE SULFUR CONTENT - %                   ******
      AVERAGE CHLORIDE CONTENT - %               ********
      RANGE CHLORIDE CONTENT - %                 ******
      FUEL FIRING RATE - M T/H                   *******       (*** TPH)
      FUEL FIRING RATE - MW                      *****

 ** FGD SYSTEM
      SALEABLE PRODUCT/THROWAWAY PRODUCT         THROWAWAY PRODUCT
      GENERAL PROCESS TYPE                       WET SCRUBBING
      PROCESS TYPE                               LIME/LIMESTONE
      SYSTEM SUPPLIER                            AIR CORRECTION DIVISION, UOP
      A-E FIRM                                   BECHTEL
      CONSTRUCTION FIRM                          TVA
      DEVELOPMENT LEVEL                          PROTOTYPE
      NEW/RETROFIT                               RETROFIT
      INITIAL START-UP                            4/72

 ** ABSORBER
      TYPE                                       TURBULENT CONTACT ABSORBER
      INITIAL START UP                            4/72
      SUPPLIER                                   AIR CORRECTION DIVISION, UOP
      NUMBER OF STAGES                               2
      GAS FLOW - CU.M/S                            14.16        (  30000 ACFM)
      GAS TEMPERATURE - C                         148.9         (  300 F)
      PARTICULATE INLET LOAD - G/CU.M               6.9         ( 3.000 GR/SCF)
      SO2 INLET CONCENTRATION - PPM               2900

 ** MIST ELIMINATOR
      NUMBER                                      1
      TYPE                                       CHEVRON
      WASH SYSTEM                                INTERMITTENT WASHING WITH AVAILABLE RAW WATER

 ** REHEATER
      TYPE                                       DIRECT COMBUSTION
```

PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
0/79	SYSTEM										

```
** PROBLEMS/SOLUTIONS/COMMENTS
        START DATE    0/72       EQUIPMENT: FGD SYSTEM, GENERAL
        END DATE      0/79       COMMENTS:
                                 REFER TO PERFORMANCE UPDATE INFORMATION FOR SHAWNEE 10B.
        AFFECTED MODULES: SYSTEM
```

SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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COMPANY NAME                                    TENNESSEE VALLEY AUTHORITY
PLANT NAME                                      SHAWNEE
UNIT NUMBER                                     10B
CITY                                            PADUCAH
STATE                                           KENTUCKY
REGULATORY CLASSIFICATION                       C
PARTICULATE EMISSION LIMITATION - NG/J            43.         (  .100 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                   516.         ( 1.200 LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW              1750.0
GROSS UNIT GENERATING CAPACITY - MW               10.0
NET UNIT GENERATING CAPACITY W/FGD - MW           10.0
NET UNIT GENERATING CAPACITY WO/FGD - MW        *******
EQUIVALENT SCRUBBED CAPACITY - MW                 10.0

** BOILER DATA
   SUPPLIER                                     ******
   TYPE                                         BASE
   SERVICE LOAD                                 ******
   COMMERCIAL SERVICE DATE                      **/**
   MAXIMUM BOILER FLUE GAS FLOW - CU.M/S        *********     (******* ACFM)
   FLUE GAS TEMPERATURE - C                     *******       (**** F)
   STACK HEIGHT - M                             ******        (**** FT)
   STACK TOP DIAMETER - M                       *******       (***** FT)

** FUEL DATA
   FUEL TYPE                                    COAL
   FUEL GRADE                                   BITUMINOUS
   AVERAGE HEAT CONTENT - KJ/KG                 *******       (****** BTU/LB)
   RANGE HEAT CONTENT - BTU/LB                                 ******
   AVERAGE ASH CONTENT - %                      ********
   RANGE ASH CONTENT - %                        ******
   AVERAGE MOISTURE CONTENT - %                 ********
   RANGE MOISTURE CONTENT - %                   ******
   AVERAGE SULFUR CONTENT - %                      2.90
   RANGE SULFUR CONTENT - %                     ******
   AVERAGE CHLORIDE CONTENT - %                 ********
   RANGE CHLORIDE CONTENT - %                   ******
   FUEL FIRING RATE - M T/H                     *******       (*** TPH)
   FUEL FIRING RATE - MW                        *****

** PARTICULATE SCRUBBER
   NUMBER                                         1
   TYPE                                         VENTURI
   SUPPLIER                                     CHEMICO
   FLUE GAS CAPACITY - CU.M/S                     14.2        (  30000 ACFM)
   FLUE GAS TEMPERATURE - C                      148.9        (  300 F)

** FGD SYSTEM
   SALEABLE PRODUCT/THROWAWAY PRODUCT           THROWAWAY PRODUCT
   GENERAL PROCESS TYPE                         WET SCRUBBING
   PROCESS TYPE                                 LIME/LIMESTONE
   SYSTEM SUPPLIER                              CHEMICO
   A-E FIRM                                     BECHTEL
   CONSTRUCTION FIRM                            TVA
   DEVELOPMENT LEVEL                            PROTOTYPE
   NEW/RETROFIT                                 RETROFIT
   INITIAL START-UP                              4/72

** ABSORBER
   NUMBER                                         1
   TYPE                                         SPRAY TOWER
   INITIAL START UP                              4/72
   SUPPLIER                                     CHEMICO
   GAS FLOW - CU.M/S                              14.16       (  30000 ACFM)
   GAS TEMPERATURE - C                           148.9        (  300 F)

** MIST ELIMINATOR
   NUMBER                                         1

** REHEATER
   TYPE                                         DIRECT COMBUSTION
```

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-------------------------------------------PERFORMANCE DATA----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

 0/72  SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   0/72     EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE     0/72     COMMENTS: RESEARCH AND DEVELOPMENT
                                      IN JUNE 1968, THE EPA INITIATED A PROGRAM TO TEST PROTOTYPE LIME AND
                                 LIMESTONE SYSTEMS FOR REMOVAL OF SULFUR DIOXIDE AND PARTICULATE FROM COAL-
                                 FIRED BOILER FLUE GASES. THE PROGRAM WAS CARRIED OUT IN A TEST FACILITY
                                 INCORPORATED INTO THE FLUE GAS DUCTWORK OF UNIT NO. 10, A COAL-FIRED BOIL-
                                 ER AT THE TVA SHAWNEE POWER STATION, PADUCAH,KENTUCKY. TVA IS THE CON-
                                 STRUCTION AND FACILITY OPERATOR AND BECHTEL CORP. IS CONTRACTOR, TEST
                                 DIRECTOR AND REPORT WRITER.
                                      THE TEST FACILITY CONSISTS OF THREE PARALLEL SCRUBBER SYSTEMS OF PRO-
                                 TOTYPE SIZE, TREATING PART OF THE FLUE GAS FROM THE BOILER. EACH SCRUBBER
                                 TRAIN IS CAPABLE OF TREATING APPROXIMATELY 30,000 ACFM OR THE EQUIVALENT
                                 OF APPROXIMATELY 10 MW OF POWER PLANT GENERATING CAPACITY.
                                      THREE PARALLEL WET SCRUBBER SYSTEMS WERE SELECTED FOR THE TEST PRO-
                                 JECT: 1) A VENTURI WITH A SPRAY TOWER AFTER ABSORBER, 2) A TURBULENT CON-
                                 TACT ABSORBER (TCA), AND 3) A MARBLE-BED ABSORBER. THE VENTURI SYSTEM,
                                 MANUFACTURED BY CHEMICAL CONSTRUCTION CO., CONTAINS AN ADJUSTABLE THROAT
                                 THAT PERMITS CONTROL AND VARIATION OF PRESSURE DROP OVER A WIDE RANGE OF
                                 FLOW CONDITIONS. THE TCA UNIT, MANUFACTURED BY UNIVERSAL OIL PRODUCTS,
                                 INCORPORATES A FLUIDIZED BED OF LOW DENSITY PLASTIC SPHERES THAT ARE FREE
                                 TO MOVE BETWEEN RETAINING GRIDS. THE MARBLE BED ABSORBER, SUPPLIED BY
                                 COMBUSTION ENGINEERING CO., USES A PACKING OF 3/4-INCH GLASS MARBLE
                                 SPHERES AND A TURBULENT LAYER OF LIQUID AND GAS ABOVE THE MARBLE LAYER TO
                                 ENHANCE MASS TRANSFER.
                                      IN JUNE 1974, THE EPA BEGAN A 3-YEAR ADVANCED TEST PROGRAM AT THE
                                 SHAWNEE FACILITY WITH THESE MAJOR GOALS: (1) CONTINUATION OF LONG-TERM
                                 TESTING, WITH EMPHASIS PLACED UPON THE RELIABLE OPERATION OF MIST ELIMINA-
                                 TION SYSTEMS AT INCREASED GAS VELOCITY, (2) INVESTIGATION OF ADVANCED PRO-
                                 CESS AND EQUIPMENT DESIGN VARIATIONS FOR IMPROVING EQUIPMENT RELIABILITY
                                 AND PROCESS ECONOMICS, AND (3) LONG-TERM RELIABILITY TESTING ON PROMISING
                                 PROCESS AND EQUIPMENT DESIGN VARIATIONS.
                                      THE TWO PARALLEL SCRUBBING SYSTEMS OPERATING DURING THE ADVANCED PRO-
                                 GRAM ARE THE VENTURI/SPRAY TOWER SYSTEM AND THE TCA UNIT. GENERAL PROCESS
                                 FLOW DIAGRAMS OF THE TWO PROTOTYPE UNITS ARE PROVIDED IN APPENDIX B. OPER-
                                 A TION OF THE MARBLE-BED ABSORBER UNIT HAS BEEN PERMANENTLY DISCONTINUED.
                                      EACH OF THE SCRUBBING SYSTEMS CONTAINS ITS OWN SLURRY HANDLING FACIL-
                                 ITIES AND CAN TREAT APPROXIMATELY 30,000 ACFM OF GAS AT 300 F CONTAINING
                                 1800 TO 4000 PPM OF SULFUR DIOXIDE AND 2 TO 4 GRAINS/SCF OF PARTICULATE.
                                 BOILER NO. 1 NORMALLY BURNS A HIGH-SULFUR BITUMINOUS COAL.
                                      FROM JUNE 1974 TO JANUARY 1976, MIST ELIMINATION AND LIMESTONE UTILI-
                                 ZATION TESTS WERE CONDUCTED AT THE SHAWNEE FACILITY. DURING THIS TEST PER-
                                 IOD THE VENTURI/SPRAY TOWER SYSTEM WAS OPERATED ON BOTH LIME AND LIMESTONE
                                 AND THE TCA SYSTEM WITH LIMESTONE. TESTING WAS PERFORMED UNDER A CLOSED-
                                 WATER OPERATION MODE. DURING THIS PERIOD THE SLURRY SOLIDS CONTAINED AP-
                                 PROXIMATELY 40 TO 50 PERCENT-BY-WEIGHT FLY ASH BECAUSE OF RELATIVELY HIGH
                                 GAS INLET PARTICULATE LOADING. THIS TESTING PROGRAM IS SCHEDULED TO RUN
                                 THROUGH TO FEBRUARY 1978.

                                      ADDITIONAL INFORMATION AND DATA CONCERNING THE DETAILS OF THE ADVANCED
                                 TEST PROGRAM ARE PRESENTED IN THE PERFORMANCE TABLE THAT FOLLOWS.
           AFFECTED MODULES: SYSTEM

 9/75  SYSTEM                                                                        720

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   9/75     EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE    10/75     COMMENTS: RESEARCH AND DEVELOPMENT
                                 THIS EXPERIMENTAL EPA-FUNDED OPERATION IS PROCEEDING WITH THE TEST PROGRAM
                                 TWO ABSORBER MODULES ARE CURRENTLY OPERATIONAL (10 MW EACH). THE MARBLE-BE
                                 ABSORBER IS STILL INOPERATIVE (SINCE JULY 1973). CURRENT EXPERIMENTS ARE
                                 RELATED TO MIST ELIMINATOR SECTION.
           AFFECTED MODULES: SYSTEM

10/75  SYSTEM                                                                        744
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------------------------------------------PERFORMANCE DATA---------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                 SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------

11/75  SYSTEM                                                                720

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE  11/75     EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE    12/75     COMMENTS: RESEARCH AND DEVELOPMENT
                       RECENT TESTING AT SHAWNEE HAS SHOWN THAT THE CHEVRON MIST ELIMINATORS IN
                       BOTH THE SPRAY TOWER AND THE TCA CAN BE KEPT FREE OF SOLIDS BUILDUP AT HIG
                       ALKALI UTILIZATION (GREATER THAN 80 PERCENT), USING ONLY INTERMITTANT
                       WASHING WITH AVAILABLE RAW WATER. THIS HIGH UTILIZATION IS NORMALLY
                       ACHIEVED WITH LIME. IT HAS BEEN ACHIEVED WITH LIMESTONE AT REDUCED SCRUBBE
                       INLET SLURRY PH (ABOUT 5.2) AND WITH THREE EFFLUENT TANKS IN SERIES TO SIM
                       ULATE A PLUG-FLOW REACTOR. TESTING IS CONTINUING TO DETERMINE THE EFFECTS
                       OF PROCESS VARIABLES ON MIST ELIMINATOR PERFORMANCE AND ON LIMESTONE UTILI
                       ZATION. FUTURE PLANS INCLUDE: (1) FACTORIAL TESTING WITH LIME AND LIMESTON
                       TO DETERMINE THE EFFECTS OF PROCESS VARIABLES ON SO2 REMOVAL AND (2) TEST-
                       ING THE OXIDATION OF SLUDGE TO GYPSUM IN THE VENTURI/SPRAY TOWER SYSTEM
                       USING AIR SPARGING OF AN ACIDIFIED SLURRY BLEED STREAM.
           AFFECTED MODULES: SYSTEM

12/75  SYSTEM                                                                744

 1/76  SYSTEM                                                                744

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   1/76     EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE     2/76     COMMENTS: RESEARCH AND DEVELOPMENT
                       THE ADVANCED TEST PROGRAM IS CONTINUING. HIGHLIGHTS OF THE PROGRAM ARE AS
                       FOLLOWS:
                       EVALUATE SCRUBBER OPERABILITY DURING VARIABLE LOAD OPERATION.
                       CONTINUE LONG-TERM RELIABILITY TESTING.
                       INVESTIGATE METHODS FOR IMPROVING WASTE SOLIDS SEPARATION.
                       CONTINUE SLUDGE OXIDATION AND SLUDGE FIXATION STUDY PROGRAMS.
                       EVALUATE SYSTEM PERFORMANCE AT REDUCED FLY ASH LOADING.
                       DETERMINE THE PRACTICAL UPPER LIMITS OF SO2 REMOVAL EFFICIENCY.
                       EVALUATE ADDITION OF MAGNESIUM ION TO THE SCRUBBING SLURRY.
                       CHARACTERIZE ALL STACK GAS EMISSION COMPONENTS.
                       EVALUATE MATERIALS OF CONSTRUCTION OF ALL SCRUBBER AND PLANT-RELATED
                       COMPONENTS.
                       DEVELOPE A COMPUTER PROGRAM FOR DESIGN AND COST ANALYSIS OF FULL-SCALE
                       LIME/LIMESTONE SYSTEM.
           AFFECTED MODULES: SYSTEM

 2/76  SYSTEM                                                                696

 3/76  SYSTEM                                                                744

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   3/76     EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE     4/76     COMMENTS: RESEARCH AND DEVELOPMENT
                       BECHTEL REPORTED THAT THE FACTORIAL TEST PROGRAM, EVALUATING THE PERFOR-
                       MANCE OF THE LIME/LIMESTONE SCRUBBING SYSTEMS WITH AND WITHOUT MAGNESIUM
                       ADDITION HAS BEEN COMPLETED. CURRENTLY TESTING IS PROCEEDING ON THE EVALUA
                       TION OF SYSTEM PERFORMANCE AS A FUNCTION OF LOW RESIDENCE TIMES (1.5 TO 5.
                       MINUTES) IN THE RECYCLE TANKS. IN ADDITION, A FLY ASH-FREE DUCT IS BEING
                       INSTALLED AT THE TEST FACILITY, THUS ENABLING EVALUATION OF SYSTEM PERFOR-
                       MANCE IN THE ABSENCE OF FLY ASH.
           AFFECTED MODULES: SYSTEM

 4/76  SYSTEM                                                                720

 5/76  SYSTEM                                                                744

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   5/76     EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE     6/76     COMMENTS: RESEARCH AND DEVELOPMENT
                       THE TEST DIRECTOR, BECHTEL, PROVIDED THE FOLLOWING INPUT CONCERNING THE
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-----------------------------------------PERFORMANCE DATA---------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
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                          OPERATION OF THE EXPERIMENTAL SCRUBBING SYSTEMS DURING THE REPORT PERIOD.

                          THE EFFECT OF MGO ADDITION WAS EXPLORED IN BOTH SCRUBBER SYSTEMS. RESOLTS
                          INDICATE MAGNESIUM ION IN THE SCRUBBER SLURRY LIQUOR ENHANCES SO2 REMOVAL
                          AND CAN DEPRESS SULFATE SUPERSATURATION. IT WAS FOUND THAT THE MAGNESIUM
                          ION CONCENTRATION HAD TO EXCEED THE EQUIVALENT CHLORIDE ION CONCENTRATION
                          TO HAVE AN EFFECT ON SO2 REMOVAL.
                          IN THE TCA UNIT, WITH LIMESTONE SLURRY, SO2 REMOVAL WAS INCREASED FROM 75
                          TO 95 PERCENT BY INCREASING THE MAGNESIUM ION CONCENTRATION TO 9,000 PPM
                          IN EXCESS OF EQUIVALENT EQUAL TO 6 PERCENT BY WEIGHT OF THE LIMESTONE AD-
                          DITION RATE. IN THE VENTURI/SPRAY TOWER SYSTEM, WITH LIME SLURRY, SO2 RE-
                          MOVAL WAS INCREASED FROM 75 TO 90 PERCENT BY INCREASING THE MAGNESIUM ION
                          CONCENTRATION TO 2,000 PPM IN EXCESS OF EQUIVALENT CHLORIDE ION. THE MAG-
                          NESIUM OXIDE ADDITION RATE WAS 2 PERCENT BY WEIGHT OF THE LIME ADDITION
                          RATE. BOTH SCRUBBING SYSTEMS OPERATED IN THE SUBSATURATED SULFATE MODE
                          WHEN MAGNESIUM OXIDE WAS ADDED. INLET SO2 CONCENTRATIONS DURING THE TESTS
                          AVERAGE APPROXIMATELY 3,000 PPM DURING THESE TESTS.
                          FOLLOWING THE TEST BLOCKS MENTIONED ABOVE, BOTH SCRUBBERS ARE OPERATING
                          WITH LIME SLURRY SCRUBBING SOLUTIONS, THE TCA SYSTEM ON FLUE GAS CONTAIN-
                          ING FLY ASH AND THE VENTURI/SPRAY TOWER SYSTEM ON FLY ASH-FREE FLUE GAS.
            AFFECTED MODULES: SYSTEM

 6/76   SYSTEM                                                                     720

 7/76   SYSTEM                                                                     744

     ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   7/76      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     8/76      COMMENTS: RESEARCH AND DEVELOPMENT
                          EXPERIMENTAL OPERATION OF THE EPA/TVA ALKALI SCRUBBING TEST FACILITY CON-
                          TINUED DURING THE REPORT PERIOD. BECHTEL, THE TEST DIRECTOR, PROVIDED THE
                          FOLLOWING INPIT CONCERNING THE OPERATION OF THE PROTOTYPE TEST UNITS.
                          VENTURI/SPRAY TOWER SYSTEM: THIS SYSTEM RAN OFF FLY ASH-FREE FLUE GAS USIN
                          A LIME SLURRY SCRUBBING SOLUTION. NO SIGNIFICANT DIFFERENCES IN SO2 REMOV-
                          AL, GYPSUM SATURATION AND SULFITE OXIDATION WERE DETECTED (VERSUS FLY ASH-
                          LADEN FLUE GAS). ONE DIFFERENCE NOTED WAS THE FILTER LAKE SOLIDS CONTENT
                          WHICH WAS APPROXIMATELY 10 PERCENT LOWER FOR THE FLY ASH-FREE SLUDGE (40
                          TO 50 PERCENT SOLIDS)VERSUS THE FLY ASH-LADEN SLUDGE 150 TO 60 PERCENT
                          SOLIDS. IN ADDITION OPERATION IN A LOW RESIDENCE TIME MODE(3MINUTES)WAS
                          EXPLORED. SCALE-FREE OPERATION WAS ACHIEVED IN THIS MODE UNDER THE FOLLOW-
                          ING CONDITIONS: 8 PERCENT SOLIDS (NO FLY ASH) IN THE RECIRCULATED SLURRY,
                          PH OF THE SCRUBBER LIQUID INLET WAS 8.0, SUPERFICIAL GAS VELOCITY OF 9.4
                          FT/SEC., AND A TOTAL LIQUID-TO-GAS RATIO (L-G) OF 7.1 GAL/MCF. SOME SCALE
                          FORMATION OCCURRED WHEN THE SOLIDS CONTENT OF THE RECIRCULATED SLURRY
                          DROPPED BELOW THE 4 PERCENT LEVEL.
                          TCA SYSTEM: THIS SYSTEM OPERATED ON FLY ASH-LADEN FLUE GAS USING A LIME
                          SLURRY SCRUBBING SOLUTION INNOCULATED WITH MAGNESIUM OXIDE. GYPSUM SUBSAT-
                          URATION OPERATION WAS ACHIEVED UNDER THE FOLLOWING CONDITIONS: MAGNESIUM
                          ION CONCENTRATION EXCEEDED THE CHLORIDE ION CONCENTRATION BY 2000 PPM, SU-
                          PERFICIAL GAS VELOCITY WAS 12.5 FT/SEC., L/G WAS 50. THE SCRUBBING SOLU-
                          TION INLET PH WAS 7.0, AND RESIDENCE TIME WAS 4 MINUTES. THE SO2 REMOVAL
                          EFFICIENCY WAS APPROXIMATELY 90 PERCENT. WHEN L/G WAS REDUCED TO 37, WHILE
                          ALL OTHER CONDITIONS REMAINED CONSTANT, SEVERE GYPSUM SCALE FORMATION RE-
                          SULTED INCREASING THE EFFECTIVE MAGNESIUM CONCENTRATION TO 4000 PPM AND
                          THE SCRUBBER LIQUID INLET PH TO 8.0 DID NOT AMELIORATE THE SCALE PROBLEM.
                          PRESENTLY THE VENTURI/SPRAY TOWER SYSTEM IS OPERATING ON FLY ASH-FREE FLUE
                          GAS WITH MAGNESIUM OXIDE-INNOCULATED LIME SCRUBBING SLURRY.
            AFFECTED MODULES: SYSTEM

 8/76   SYSTEM                                                                     744

 9/76   SYSTEM                                                                     720

     ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   9/76      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE    10/76      COMMENTS: RESEARCH AND DEVELOPMENT
                          IN SEPTEMBER AND OCTOBER 1976 THE VENTURI/SPRAY SYSTEM WAS OPERATED WITH
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                                SECTION 3
                DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
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-----------------------------------PERFORMANCE DATA--------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
                        FLY ASH-FREE FLUE GAS USING LIME SLURRY WITH ADDED MGO TYPICAL
                        TEST CONDITIONS WERE 9.4 FT/SEC SPRAY TOWER GAS VELOCITY, 21 GAL/MCF VENTU
                        RI L/G, 50 GAL/MCF SPRY TOWER L/G, 8 PERCENT SLURRY SOLIDS (FLY ASH FREE)*
                        3 MINUTES RESIDENCE TIME, 7.0 SCRUBBER INLET PH, AND 2000 PPM EFFECTIVE
                        MAGNESIUM ION CONCENTRATION (1.F., EXCESS OVER EQUIVALENT CHLORIDE ION).
                        RESULTS WERE NOT CONSISTENT AT THESE CONDITIONS. DURING ONE PERIOD, SCRUB-
                        BING INLET LIQUOR GYPSUM SATURATION AVERAGED 85 PERCENT WITH 80 PERCENT SO
                        REMOVAL WITH SOME GYPSUM SCALS FORMATION. IN A LATER PERIOD, AT SEEMINGLY
                        IDENTICAL TEST CONDITIONS GYPSUM SATURATIONS DROPPED TO 10 PERCENT  WITH 9
                        PERCENT SO2 REMOVAL AND THE SCRUBBER DESCALED. A SEVEN-WEEK PROGRAM OF IN-
                        TENSIVE FLUE GAS CHARACTERIZATION TESTING WAS STARTED IN MID-OCTOBER ON
                        THE VENTURI/SPRAY TOWER SYSTEM. THESE TESTS ARE BEING MADE TO MEASURE
                        SIMULATANEOUS INLET AND OUTLET FLUE GAS PARTICULATE MASS LOADING, PARTI-
                        CULATE SIZE DISTRIBUTION AND GASEOUS SO3 CONCENTRATION. THE TCA SYSTEM
                        CONTINUED TO OPERATE DURING THIS PERIOD ON FLY ASH-LADEN FLUE GAS USING
                        LIME SLURRY WITH ADDED MGO.THE TEST RESULTS SO FAR INDICATED THAT THE
                        DEGREE OF SULFATE(GYPSUM)SATURATION IS A SENSITIVE FUNCTION OF THE
                        EFFLUENT RESIDENCE TIME CONDITIONS:GAS VELOCITY 12.5 FT/SEC, L/G OF 50, PH
                        OF 7.0, 2000 PPM OF MG ION, AND 8 PERCENT SOLIDS. AT THESE CONDITIONS
                        GYPSUM SATURATION WERE 95,50,AND 92 PERCENT,AT RESIDENCE TIMES OF 3,4,AND
                        12 MINUTES,RESPECTIVELY.FURTHER TESTS WERE RUN AT 37 GAL/MCF L/G,AND 8.0
                        INLET PH WITH OTHER CONDITIONS THE SAME. DURING THESE TESTS GYPSUM SATURA-
                        TIONS WERE 95, 95, 50, AND 90 PERCENT AT 3, 4, 5.4, AND 16 MINUTES RESI-
                        DENCE TIMES, RESPECTIVELY.
            AFFECTED MODULES: SYSTEM

10/76   SYSTEM                                                               744

11/76   SYSTEM                                                               720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   11/76      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     12/76      COMMENTS: RESEARCH AND DEVELOPMENT
                        FROM MID-OCTOBER THROUGH EARLY DECEMBER AN INTENSIVE FLUE GAS CHARACTERI-
                        ZATION TESTING PROGRAM WAS CONDUCTED ON THE VENTURI/SPRAY TOWER SYSTEM
                         WITH LIME SLURRY. OVER THE RANGE TESTED, OUTLET PARTICULATE MASS LOADING
                         WAS FOUND TO BE INDEPENDENT OF SLURRY COMPOSITION (8 TO 15 PERCENT
                         SUSPENDED SOLIDS, 3,000 TO 16,000 PPM DISSOLVED SOLIDS), GAS FLOW RATE
                         (20,000 TO 35,000, ACFM), SPRAY TOWER LIQUID RATE (0 TO 1,400 GPM) AND
                         VENTURI PRESSURE DROP (3 TO 9 INCHES H2O). WITH 4 TO 6 GR/DSCF PARTICULATE
                         IN THE INLET TYPICAL OUTLET LOADINGS WERE 0.02 TO 0.04 GR/DSCF. WHEN OPER-
                         ATING WITH FLUE GAS FROM THE ELECTROSTATIC PRECIPITATOR (0.1 TO 0.4
                         GR/DSCF TO THE SCRUBBER), THE SCRUBBER OUTLET LOADING AVERAGED 0.005
                         GR/DSCF. THUS, ENTRAINED SLURRY FROM THE M.E. MUST HAVE BEEN LESS THAN
                         0.005GR/DSCF. SIZE DISTRIBUTION DATA ARE STILL BEING ANALYZED. SULFURIC
                         ACID MIST VALUES WERE APPROXIMATELY 2 TO 25 PPM AT THE SCRUBBER INLET AND
                         REMOVALS HAVE BEEN ABOUT 50 TO 75 PERCENT.
                         THE REMAINDER OF DECEMBER THE VENTURI/SPRAY TOWER SYSTEM WAS DOWN FOR MOD-
                         IFICATIONS FOR TWO-STAGE OXIDATION TESTING. SEE APPENDIX B FOR A PROCESS
                         FLOW DIAGRAM.
                         DURING NOVEMBER THE TCA WAS OPERATING WITH FLY ASH-CONTAINING FLUE GAS US-
                         ING LIME SLURRY WITHOUT ADDED MAGNESIUM OXIDE. OPERATING CONDITIONS WERE
                         12.5 FT/SEC GAS VELOCITY, 50 GAL/MCF L/G, 8.0 SCRUBBER INLET PH, AND 8 TO
                          15 PERCENT SLURRY SOLIDS.  AT THESE CONDITIONS THE SO2 REMOVAL WAS ABOUT
                        PERCENT.
                          FLY ASH-FREE LIMESTONE TESTS WITHOUT MAGNESIUM OXIDE ADDITION BEGAN ON TH
                         TCA SYSTEM IN LATE NOVEMBER.  TYPICAL OPERATING CONDITIONS WERE 12.5 FT/SE
                         GAS VELOCITY, 50 GAL/MCF L/G, AND 1.1 TO 1.2 STOICHIOMETRIC RATIO.  AT THE
                         SAME STOICHIOMETRY, THE PH OF THE FLY ASH-FREE SLURRY WAS 0.2 TO 0.3 UNITS
                        HIGHER THAN OBSERVED IN PREVIOUS RUNS WITH FLY ASH.
            AFFECTED MODULES: SYSTEM

12/76   SYSTEM                                                               744

 1/77   SYSTEM                                                               744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/77       EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     2/77       COMMENTS: RESEARCH AND DEVELOPMENT
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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-------------------------------------PERFORMANCE DATA-----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION % REMOVAL    PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                          THE VENTURI/SPRAY TOWER SYSTEM HAS BEEN OPERATED IN A TWO-SERIES-SCRUBBER
                          MODE WITH FORCED OXIDATION SINCE EARLY JANUARY 1977 AFTER SYSTEM MODIFICA-
                          TIONS TO ALLOW OPERATION OF THE VENTURI AND SPRAY TOWER WITH INDEPENDENT
                          SLUR RY RECIRCULATION LOOPS. SULFITE OXIDATION WAS CARRIED OUT IN AN 8 FT
                          DIAMETER VENTURI (PRE-SCRUBBER) EFFLUENT HOLD TANK WHICH HAD AN AIR SPARG-
                          WITH 130-1/8 INCH HOLES IMMERSED IN 18 FT OF SLURRY. THE SRAY TOWER (AFTER
                          SCRUBBER) FUNCTIONED AS A PRIMARY SO2 ABSORBER.
                          TYPICAL OPERATION CONDITIONS, USING LIMESTONE SLURRY, WERE 6.7 FT/SEC SPAY
                         TOWER GAS VELOCITY, 20-30 GAL/MCF VENTURI L/G, 70 GAL/MCF SPRAY TOWER L/G
                          15 PERCENT SOLIDS (WITH FLY ASH) IN VENTURI RECIRCULATED SLURRY, 4.5-5.0
                          VENTURI INLET (OXIDATION TANK) PH, AND 11.3 MINUTES OXIDATION TANK RESI-
                         DENCE TIME (BASED ON 600 GPM SLURRY FLOW TO VENTURI).  DURING THESE TESTS.
                          AVERAGE OVERALL SULFITE OXIDATION RANGED FROM 93 TO 99 PERCENT AT AIR
                          STOICHIOMETRIC RATIO OF 1.0 TO 4.7 LB-ATOMS OXYGEN/LB-MOLE SO2 ABSORBED.
                          CORRESPONDING AVERAGE OXIDATION IN THE SPRAY TOWER RANGED FROM 10 TO 16 %
                          AVERAGE OVERALL LIMESTONE UTILIZATION RANGED FROM 83 TO 96 %
                          SCALING WAS EXPERIENCED IN EITHER SCRUBBER. AVERAGE FILTER CAKE SOLIDS
                          WERE 79 TO 86 % BY WEIGHT COMPARED WITH 55-65 % WITHOUT FORCED OXIDATION.
                          SLURRY SOLIDS SETTLING RATE RANGED 0.5 TO 1.4 CM/MIN, 5 TO 10 TIMES
                          FASTER THAN THAT FOR UNOXIDIZED SLURRY. FINAL SETTLED DENSITY RANGED 65-80
                          PERCENT SOLIDS COMPARED WITH 45-60 PERCENT FOR SLURRY WITHOUT FORCED OXI-
                          DATION.
                          FLY ASH-FREE LIMESTONE TESTING ON THE TCA SYSTEM WAS COMPLETED IN EARLY
                          FEBRUARY. THE PH OF THE FLY ASH-FREE SLURRY WAS 0.2 TO 0.3 UNITS HIG HER
                          THAN OBSERVED IN PREVIOUS RUNS WITH FLY ASH. IN ADDITION THE FLY ASH-FREE
                          SLURRY APPEARED TO HAVE INFERIOR SOLIDS DEWATERING CHARACTERISTICS. FOR
                          EXAMPLE THE CENTRIFUGE CAKE SOLIDS AVERAGED ABOUT 50 % COMPARED WITH
                          ABOUT 60 PERCENT FOR SLUDGE CONTAINING FLY ASH.
                          INTENSIVE FLUE GAS CHARACTERIZATION TESTING WITH LIMESTONE SLURRY ON THE
                          TCA SYSTEM BEGAN IN EARLY FEBRUARY AND ENDED IN EARLY MARCH 1977. PRELIM-
                          INARY ANALYSIS OF THE DATA SHOWED AN OUTLET MASS LOADING OF 0.4-0.8
                          GR/DSCF FLY ASH AND 0.02-0.03 GR/DSCF FOR FLUE GAS WITHDRAWN DOWNSTREAM OF
                          THE ESP.IT WAS ESTIMATED THAT THESE OUTLET MASS LOADINGS CONTAINED ABOUT
                          0.03 GR/DSCF FLY ASH,0.02 GR/DSCF REENTRAINED SLURRY SOLIDS AND 0.015
                          ENTRAINED DISSOLVED SOLIDS(WHEN A CONTINUOUS MIST ELIMINATOR UNDER WASH
                          WAS USED. THESE VALUES VARY DEPENDING ON THE MIST ELIMINATOR WASH SCHEME
                          AND GAS FLOW RATE.
              AFFECTED MODULES: SYSTEM

2/77   SYSTEM                                                                  672

3/77   SYSTEM                                                                  744

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  3/77        EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE    3/77        COMMENTS: RESEARCH AND DEVELOPMENT
                          DURING MARCH THE VENTURI/SPRAY TOWER WAS TESTED WITH LIME SLURRY AND FLY
                          ASH LADEN FLUE GAS IN A TWO-STAGE SCRUBBER MODE WITH FORCED OXIDATION OP-
                          ERATION WITH LIME WAS SIMILAR TO THE PREVIOUSLY REPORTED LIMESTONE OPERA-
                          TION WITH GREATER THAN 95 PERCENT OXIDATION AT AN AIR STOICHIOMETRIC RATIO
                          OF 1.5 LB-ATOMS OXYGEN/LB-MOLE SO2 ABSORBED WITH A SIMPLE AIR SPARGER IN
                          VENTURI HOLD TANK. SLURRY SOLIDS SETTLING RATE VARIED FROM 0.6 TO 1.9 CM/
                          MIN (A 5 TO 10-FOLD ENHANCEMENT OVER UNOXIDIZED SLURRY) AND FILTER CAKE
                          SOLIDS RANGED FROM 74 TO 89 PERCENT COMPARED TO 45 TO 60 PERCENT WITH UN-
                          OXIDIZED SLURRY).
                          TWO MAJOR DIFFERENCES BETWEEN LIME AND LIMESTONE WERE OBSERVED IN A TWO-
                          STAGE FORCED OXIDATION SYSTEM TO MAINTAIN PH CONTROL IT WAS NECESSARY TO
                          FEED LIME TO BOTH STAGES. WITH LIMESTONE, FEED ONLY TO THE SECOND STAGE WA
                          WAS ADEQUATE. TO MAINTAIN MAX SO2 REMOVAL, IT WAS NECESSARY TO OPERATE
                          WITH A HIGH SLURRY SOLIDS CONCENTRATION IN THE SPRAY TOWER LOOP WITH LIME-
                          STONE (15 PERCENT)THAN WITH LIME (6 PERCENT), RESULTING IN A TIGHTER WATER
                          BALANCE WITH LIMESTONE AND INADEQUATE WATER TO FLUSH THE MIST ELIMINATOR.
                          PRELIMINARY LIMESTONE TYPE AND GRIND TESTS MADE ON THE TCA SYSTEM DURING
                          MARCH INDICATED THAT SO2 REMOVAL IS IMPROVED BY THE USE OF FINER GROUND
                          LIMESTONE. SO  REMOVAL WITH EQUIVALENTLY GROUND FREDONIA WHITE AND LONG-
                          VEIW ALABAMA LIMSTONES WAS THE SAME. BLEEDSTREAM FORCED OXIDATION TESTS
                          ARE BEING CONDUCTED WITH A PENBERTHY ELL-3 INJECTOR IN A CLOSED LOOP
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-------------------------------------------PERFORMANCE DATA-------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL    PER  BOILER  FGD    CAP.
                                                                SO2  PART.  HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                       AROUND A BLEED STREAM HOLD TANK. INITIAL TESTS WERE UNSUCESSFUL DUE TO
                       HIGH PH OF 7 TO  8 IN THE HOLD TANK. BY LOWERING THE HOLD TANK PH TO 5 OR
                       6, SULFITE OXIDATION UP TO 98 PERCENT WAS ACHIEVED.
           AFFECTED MODULES: SYSTEM

 4/77   SYSTEM                                                                  720

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   4/77      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE     5/77      COMMENTS: RESEARCH AND DEVELOPMENT
                       UNIT 10 BOILER WAS SHUT DOWN FOR A SCHEDULED TWO-MONTH MAINTENANCE OUTAGE.
                       BECAUSE OF THE BOILER OUTAGE, THE SHAWNEE SCRUBBERS DID NOT OPERATE DURING
                       APRIL AND MAY.
           AFFECTED MODULES: SYSTEM

 5/77   SYSTEM                                                                  744

 6/77   SYSTEM                                                                  720

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   6/77      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE     7/77      COMMENTS: RESEARCH AND DEVELOPMENT
                       SCRUBBER OPERATION RESUMED ON JUNE 15 AFTER A 10-WEEK SCHEDULED MAINTEN-
                       ANCE OUTAGE ON THE BOILER.
                       THE VENTUR/SPRAY TOWER SYSTEM CONTINUED TO OPERATED WITH TWO SCRUBBER
                       STAGES AND FORCED OXIDATION BY MEANS OF AN AIR SPARGING RING IN THE VEN-
                       TURI HOLD TANK. IN JUNE AND JULY, OPERATION WAS WITH LIME SLURRY AND FLY
                       ASH-FREE FLUE GAS. THE SYSTEM PERFORMED WELL WITH LITTLE DIFFERENCE FROM
                       THE PREVIOUS LIME SLURRY TEST BLOCK WHEN THERE WAS FLY ASH IN THE FLUE
                       GAS TYPICAL RESULTS WERE ABOUT 97 % SULFITE OXIDATION AT AN AIR STOICHOME-
                       TRY OF 1.6 LB-ATOMS OXYGEN/LB-MOLE SO2 ABSORBED AN OXIDATION TANK PH
                       OF 5.5 TYPICAL SOLIDS SETTLING RATE WAS ABOUT 2 CM/MIN(AN ORDER OF MAGNI-
                       TUDE BETTER THAN WITH UNOXIDIZED SLURRY) AND FILTER CAKE SOLIDS AVERAGED
                       ABOUT 80 PERCENT (COMPARE WITH 45 TO 60 PERCENT WITH UNOXIDIDED SLURRY).
                       THE TCA SYSTEM OPERATED WITH FORCED OXIDATION IN THE HOLD TANK ACHIEVED BY
                       CIRCULATING SLURRY THROUGH AN AIR EDUCTOR, IN JUNE AND JULY, OPERATION WAS
                       WITH LIMESTONE SLURRY AND FLY ASH IN THE FLUE GAS. SULFITE OXIDATION WAS
                       POOR IN THE INITIAL TEST (LESS THAN 90 PERCENT MAINLY BECAUSE OF INADE-
                       QUATE AIR/SLURRY CONTACT IN THE HOLD TANK. BY INCREASING AGITATOR SPEED(TO
                       68 RPM), HOLD TANK SLURRY LEVEL (TO 12 FT) AND DECREASING PH (TO LESS THAN
                       5.5) IN THE SLURRY TO THE EDUCTOR, SULFITE OXIDATION OF 90 PERCENT WAS
                       CONSISTANTLY ACHIEVED AT AN AIR STOICHIOMETRY OF ABOUT 4.5 LB-ATOMS
                       OXYGEN/LB-MOLE SO2 ABSORBED. WASTE SOLIDS PROPERTIES WERE ENHANCED WITH
                       OXIDATION TO ABOUT THE SAME EXTENT AS OBSERVED IN THE VENTURI/SPRAY TOWER
                       SYSTEM. ADDITIONAL TESTING WILL BE DIRECTED TOWARD ACHIEVING 90% OR BETTER
                       SULFITE OXIDATION AT A REDUCED AIR STOICHIOMETRY.
           AFFECTED MODULES: SYSTEM

 7/77   SYSTEM                                                                  744

 8/77   SYSTEM                                                                  744

       ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   8/77      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE     9/77      COMMENTS: RESEARCH AND DEVELOPMENT
                       THE VENTURI/SPRAY TOWER SYSTEM CONTINUED TO OPERATE WITH TWO SCRUBBER
                       STAGES AND FORCED OXIDATION USING AN AIR SPARGER IN THE VENTURI HOLD TANK.
                       OPERATION DURING AUGUST AND SEPTEMBER WAS WITH LIMESTONE SLURRY AND FLUE
                       GAS WITH LOW FLY ASH LOADING (FLUE GAS FROM DOWNSTREAM OF THE ESP). THE
                       SYSTEM PERFORMED WELL AT 4.5 TO 5.0 OXIDATION PH, WITH LATTLE DIFFERENCE
                       FROM THE PREVIOUS LIMESTONE TESTS WHEN THE FLUE GAS HAD FLY ASH LOADING.
                       (THE PREVIOUS TESTS HAD BEEN MADE ONLY AT OXIDATION PH OF 4.5 AND 5.0).
                       FOR THE AUGUST AND SEPTEMBER TESTS, THE OXIDATION PH WAS FURTHER INCREASED
                       TO 5.5, APPROACHING THE PH IN THE SPRAY TOWER. THIS CAUSED SOME DIFFICUL-
                       TIES IN THE OXIDATION PH CONTROL AND WIDER FLUCTUATIONS IN VENTURI AND
                       SPRAY TOWER LIMSTONE STOICHIOMETRIC RATIOS, HOWEVER NEAR COMPLETE OXIDA-
                       TION WAS STILL ACHIEVED AT THE HIGHER PH. TYPICAL RESULTS WERE BETTER THAN
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR

97 PERCENT SULFITE OXIDATION AT AN AIR STOICHIOMETRY OF 1.7 ATOMS OXYGEN/MOLE SO2 ABSORBED AND AN OXIDATION PH OF 5.5. THE FILTER CAKE SOLIDS CONTENT AVERAGED BETTER THAN 85 PERCENT. TESTS WERE ALSO CONDUCTED WITHOUT THE DESUPERSATURATION TANK IN THE VENTURI SLURRY LOOP AND WITH THE OXIDATION TANK LEVEL DROPPED FROM 18 TO 14 FT WITHOUT ADVERSE EFFECTS.

DURING AUGUST AND SEPTEMBER THE TCA SYSTEM WAS OPERATED MOSTLY IN A TWO-TANK FORCE OXIDATION MODE USING AN AIR EDUCTOR. THE TCA EFFLUENT (LIMESTONE SLURRY WITH A HIGH FLU ASH LOADING) WAS COLLECTED IN A SMALL LOW-PH ALURRY HOLD TANK WHERE LIMESTONE WAS ADDED THUS TAKING ADVANTAGE OF THE LOW PH SLURRY THROUGH THE AIR EDUCTOR FOR IMPROVED SULFITE OXIDATION AND HIGH PH SLURRY TO TCA FOR PETTER SO2 REMOVAL.

TEST WERE MADE BOTH WITH THE AIR EDUCTOR MOUNTED ON TOP OF THE EFFLUENT HOLD TANK WITH DOWNWARD SLURRY DISCHARGE TO THE BOTTOM OF THE TANK. AVERAGE SULFITE OXIDATION RANGE FROM 93 TO 98 % AT ABOUT 2.5 AIR STOICHIOMETRY AND 5.2 EDUCTOR INLET PH. DURING TWO OF THE RUNS MADE IN AUGUST WHEN THE ROTARY DRUM FILTER WAS USED THE FILTER CAKE SOLIDS CONTENT AVERAGED 85 AND 88 PERCENT.

A TEN-DAY RUN WAS MADE IN SEPTEMBER ON THE TCA SYSTEM WITH AUTOMATIC LIMESTONE FEED CONTROL BASED ON STOICHIOMETRY. THE LIMESTONE SLURRY FEED RATE WAS CONTROLLED BY THE FLUE GAS FLOW RATE AND THE INLET SO2 CONCENTRATION. THE CONTROL SYSTEM WORKED WELL ACCORDING TO THE SPECIFICATIONS.

AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
9/77	SYSTEM								720		
10/77	SYSTEM								744		

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 10/77 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 11/77 COMMENTS: RESEARCH AND DEVELOPMENT

THE VENTURI/SPRAY TOWER SYSTEM CONTINUED TO OPERATE WITH TWO SCRUBBER STAGES AND FORCED OXIDATION IN THE VENTURI HOLD TANK. IN OCTOBER, THE FOLLOWING IMPROVEMENTS WERE MADE WITH NO SIGNIFICANT DROP IN OXIDATION EFFICIENCY WITH SATISFACTORY SO2 REMOVAL EFFICIENCY.

THE SPRAY TOWER GAS VELOCITY WAS INCREASED FROM 6.7 TO 9.4 FT/SEC.

THE OXIDATION TANK LEVEL WAS DRIPPED FROM 1, TO 14 FT.

THE AIR SPARGER RING CONTAINING 40 114-INCH DIAMETER HOLES, WAS REPLACED WITH A SINGLE 3-INCH DIAMETER PIPE SIDCHARGING DOWNWARD AT THE CENTER OF THE OXIDATION TANK 3 INCHES FROM THE BOTTOM.

WITH AIR DISCHARGED FROM AN OPEN-ENDED PIPE IT WAS APPARENT THAT THE AIR DISPERSION IN THE OXIDATION TANK WAS ADCOMPLISHED MAINLY BY THE TURBINE AGITATOR RATHER THAN THE STARGER. IN NOVEMBER, A ONE-MONTH RELIABILITY TEST WAS STARTED ON THE VENTURI/SPRAY TOWER SYSTEM USING FORCED OXIDATION WITH TWO SCRUBBER STAGES AND LIMESTONE SLURRY WITH HIGH FLY ASH LOADING. THE FLUE GAS RATE TO THE SCRUBBER SYSTEM WAS VARIED ACCORDING TO THE BOILER LOAD WHICH RANGED BETWEEN 100 AND 155 MW. TEST CONDITIONS WERE SELECTED TO MEET THE EPA NEW SOURCE PERFORMANCE STANDARDS OF 1.2 LBS SO2 AND 0.1 LB PARTICULATE PER MILLION BTU. THIS RUN WAS STILL IN PROGRESS AT THE END OF NOVEMBER. ON THE TCA SYSTEM, FORCED OXIDATION WITH A SINGLE SCRUBBER STAGE USING AN AIR EDUCTOR WAS SIDCONTINUED IN EARLY OCTOBER AFTER A HOLE ERODED THROUGH THE DEUCTOR BODY FORCED OXIDATION TESTING WILL BE RESUMED IN EARLY DECEMBER AFTER AN AIR SPARGER IS INSTALLED.

IN OCTOBER-NOVEMBER, A ONE-MONTH RELIABILITY TEST WITHOUT FORCED OXIDATION WAS CONDUCTED ON THE TCA SYSTEM WITH LIMESTONE SLURRY, FLUE GAS WITH HIGH FLY ASH LOADING, THREE HOLD TANKS IN SERIES, AND 7.5 INCHES STATIC HEIGHT OF NITRILE FOAM SPHERES IN EACH OF 3 BEDS IN THE TCA GAS RATE TO THE SCRUBBER WAS VARIED WITH BOILER LOAD AND STOICHIOMETRIC RATIO WAS CONTROLLED BY AN AUTOMATIC LIMESTONE FEED SYSTEM. CONDITIONS WERE SELECTED TO MEET THE EPA NEW SOURCE PERFORMANCE STANDARDS AT A LOW STOICHIOMTRIC RATIO OF 1.2 MOLES CA/MOLE SO2 ABSORBED. THE AVERAGE SO2 REMOVAL FOR THE ENTIRE RUN WAS 86 PERCENT AT 2800 PPM WHICH WAS BETTER THAN THE 83 PERCENT REQUIRED TO MEET THE EMISSIONS STANDARD. HOWEVER, THE STANDARD WAS FREQUENTLY EXCEEDED FOR PERIODS GREATER THAN THE 3 HOURS ALLOWED BY THE EPA REGULATIONS. AVERAGE OUTLET PARTICULATE MASS LOADING WAS 0.043 GRAIN/SCF DRY WHICH WAS BETTER THAN THE 0.052 GRAIN/SCF DRY (30 PERCENT EXCESSAIR) REQUIRED TO MEET THE STANDARD. THE RANGE OF THE OUTLET MASS LOADING WAS 0.026 TO 0.06[illegible] GRAIN/SCF DRY.

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-----------------------------------------PERFORMANCE DATA-------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                               SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
              AFFECTED MODULES: SYSTEM

11/77  SYSTEM                                                              720

12/77  SYSTEM                                                              744

      ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE  12/77      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     1/78      COMMINTS: RESEARCH AND DEVELOPMENT
                          A LIMESTONE RELIABILITY TEST ON THE VENTURI/SPRAY TOWER SYSTEM WAS
                          COMPLETED IN MID-DECEMBER,1977 AFTER 965 OPERATING HOURS. THE TEST WAS
                          CONDUCTED WITH TWO SCRUBBER LOOPS WITH FORCED OXIDATION IN THE FIRST(VEN-
                          TURI) LOOP. THE FLUE GAS FLOW RATE WAS VARIED ACCORDING TO THE BOILER LOAD
                          WHICH RANGED BETWEEN 100 AND 155 MW.
                          TEST CONDITIONS WERE SELECTED TO MEET THE EPA NEW SOURCE PERFORMANCE STAN-
                          DARDS OF 1.2 LB SO2 AND 0.1 LB PARTICULATE PER MILLION BTU. THE OPERATING
                          RELIABILITY OF THE SYSTEM WAS DEMONSTRATED. HOWEVER, DUE TO WIDE VARIATION
                          IN THE INLET SO2 CONCENTRATION (2500-3400 PPM) AND THE SLOW SYSTEM RE-
                          SPONSE TIME THE SO2 EMISSION STANDARD WAS FREQUENTLY EXCEEDED FOR PERIODS
                          GREATER THAN THE THREE HOURS ALLOWED BY EPA REGULATIONS. AVERAGE SO2 RE-
                          MOVAL FOR THE ENTIRE RUN WAS 86 % AT 2950 PPM AVERAGE INLET SO2 WHICH WAS
                          HIGHER THAN THE 84 % REQUIRED TO MEET THE STANDARD FOR 2800 PPM INLET
                          SO2. THE OUTLET PARTICULATE LOADING RANGED FROM 0.021 TO 0.063 GRAIN/DRY
                          SCF, WITH A RUN AVERAGE OF 0.042 GRAIN/DRY SCF. THESE VALUES COMPARE WITH
                          LOADING OF 0.052 GR/DRY SCF OR LESS REQUIRED TO MEET THE EPA PARTICULATE
                          STANDARD ASSUMING 30 PERCENT TOTAL BOILER EXCESS AIR.

                          ANOTHER RELIABILITY RUN ON THE VENTURI/SPRAY TOWER SYSTEM WAS STARTED IN
                          MID DECEMBER USING LIME SCRUBBING, THE RUN WAS COMPLETED IN JANUARY 1978.
                          WITH THE EXCEPTION OF HIGHER SPRAY TWOER INLET PH AND HIGHER ALKALI UTILI-
                          ZATION INHERENT WITH THE LIME SYSTEM, THE OPERATING CONDITIONS AND THE
                          TEST RESULTS WERE SIMILAR TO THOSE OF THE LIMESTONE RELIABILITY RUN.

                          ON THE TCA SYSTEM, TWO RUNS WERE MADE  WITH THE NITRILE FOAM SPHERES RE-
                          PLACED BY A 4[illegible] INCH HEIGHT (23 LAYERS) OF CEILCOTE PACKING SUPPORT PLATES.
                          AT FULL GAS FLOW RATE OF 30,000 ACFM, THE SO2 REMOVAL FOR THE CEILCOTE
                          PLATES WAS SLIGHTLY LESS THAN THAT OF A 3-BED, 4-GRID TCA WITH FIVE INCHES
                          OF STATIC SPHERE HEIGHT PER BED. HOWEVER, AT 1[illegible],000 ACFM THE SO2 REMOVAL
                          FOR THE CEILCOTE PLATES WAS A FEW PERCENTAGE POINTS HIGHER THAN THAT EX-
                          PERIENCED WITH THE TCA BEDS.

                          FORCED OXIDATION TESTS WERE CONDUCTED ON THE TCA SYSTEM WITH AN AIR SPARG-
                          ER USING LIMESTONE SLURRY WITH HIGH FLY ASH LOADING. BOTH ONE-TANK (AIR
                          SPARGING AND LIMESTONE ADDITION IN THE SAME TANK) AND TWO-TANK (AIR SPARG-
                          ING IN THE FIRST TANK AND LIMESTONE ADDITION IN THE SECOND) CONFIGURATIONS
                          WERE USED. NEAR COMPLETE SULFITE OXIDATION WAS ACHIEVED IN BOTH CONFIGURA-
                          TIONS AT AN AIR STOICHIOMETRY OF 1.8 ATOMS OXYGEN/MOLE SO2 ABSORBED AND
                          OXIDATION PH OF 5.4-5.7. THE OXIDATION TANK LEVEL WAS 18 FT.
              AFFECTED MODULES: SYSTEM

1/78   SYSTEM                                                              744

2/78   SYSTEM                                                              672

      ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   2/78      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     3/78      COMMINTS: RESEARCH AND DEVELOPMENT
                          MAJOR SYSTEM DOWNTIMES DURING THE PERIOD INCLUDEDD JANUARY 26 THROUGH FEB-
                          RUARY 4 FOR THE VENTURI/SPRAY TOWER AND JANUARY 26 THROUGH FEBRUARY 2 FOR
                          THE TCA SYSTEM DUE TO FREEZING WEATHER, AND MARCH 6 THROUGH MARCH 17 FOR
                          BOTH SYSTEMS DUE TO BOILER OUTAGE.
                          THE EFFECT OF THE SLURRY LEVEL IN THE AIR SPARGED OXIDATION TANK WAS IN-
                          VESTIGATED IN THE TWO SCRUBBER LOOP VENTURI/SPRAY TOWER SYSTEM WHICH IS
                          OPERATING ON LIME SLURRY WITH HIGH FLY ASH LOADING. NEAR COMPLETE SULFITE
                          OXIDATION (98 %) WAS ACHIEVED WITH 14 FT AND 18 FT OXIDATION TANK
                          LEVELS AT AN AIR STOICHIOMETRIC RATIO OF 1.8 ATOMS OXYGEN/MOLE SO2 AB-
                          SORBED. AN AIR STOICHIOMETRIC RATIO UP TO ABOUT 3.8 WAS NEEDED TO YIELD
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PERFORMANCE DATA

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL		PER	BOILER	FGD	CAP.
						SO2	PART.	HOURS	HOURS	HOURS	FACTOR

NEAR COMPLETE OXIDATION WHEN THE TANK LEVEL WAS DROPPED TO 10 FEET.
A NEW TEST BLOCK WAS STARTED ON MARCH 1 ON THE VENTURI/SPRAY TOWER SYSTEM. MAGNESIUM OXIDE WAS ADDED TO THE SPRAY TOWER SLURRY LOOP IN A TWO SCRUBBER LOOP OPERATION WITH FORCED OXIDATION IN THE VENTURI LOOP. THE SYSTEM WAS OPERATED IN A LIMESTONE SLURRY MODE WITH HIGH FLY ASH LOASING. THE PRIMARY OBJECTIVE OF MEGNESIUM ADDITION IS TO IMPROVE THE SO_2 REMOVAL EFFICIENCY. BECAUSE OF THE SHORTAGE OF COAL CAUSED BY THE LOAK MINERS' STRIKE, COALS FROM DIFFERENT SOURCES WERE BURNED IN THE BOILER. AS A RESULT, INLET SO2 CONCENTRATION FLUCTUATED AS MUCH AS TENFOLD (350-3500 PPM) CAUSING PROBLEMS IN SYSTEM CONTROL.
TCA WAS OPERATED WITH BOTH LIME AND LIMESTONE AND WITH MEGNESIUM OXIDE ADDITION. FLUE GAS WITH HIGH FLY ASH LOADING WAS USED. THESE TESTS WERE CONDUCTED PRIMARILY TO RESOLVE SOME OF THE INCONSISTENT RESULTS OBTAINED DURING EARLIER LIME/MGO AND LIMESTONE/MGO TEST MADE IN APRIL NOVEMBER 1976. AIR LEAKAGE THROUGH THE SCRUBBER DOWNCOMER WAS SUSPECTED IN SOME OF THOSE EALIER RUNS, RESULT ING IN HIGHER-THAN-NORMAL SULFITE OXIDATION AND GYPSUM SATURATION. TEST RESULTS SO FAR WERE INCONSLUSIVE BECAUSE OF THE FLUTUATION IN INLET SO2 AND CONTROL PROBLEMS MENTIONED ABOVE.

AFFECTED MODULES: SYSTEM

PERIOD	MODULE	AVAILABILITY	OPERABILITY	RELIABILITY	UTILIZATION	% REMOVAL SO2	% REMOVAL PART.	PER HOURS	BOILER HOURS	FGD HOURS	CAP. FACTOR
3/78	SYSTEM							744			
4/78	SYSTEM							720			

** PROBLEMS/SOLUTIONS/COMMENTS

START DATE 4/78 EQUIPMENT: FGD SYSTEM, GENERAL
END DATE 5/78 COMMENTS: RESEARCH AND DEVELOPMENT

THE VENTURI/SPRAY TOWER SYSTEM CONTINUED TO OPERATE THROUGH EARLY MAY WITH MGO ADDIT ION AND WITH TWO SCRUBBER LOOPS. THE SYSTEM WAS OPERATED WITH LIMSTONE SLURRY AND WITH HIGH FLY ASH LOADING. MGO WAS ADDED TO THE SPRAY TOWER SLURRY LOOP TO MAINTAIN AN EFFECTIVE MG++ ION CONCENTRATION OF 5000 PPM (ABOUT 8000 PPM IN THE VENTURI SLURRY LOOP) TO IMPROVE THE SO2 REMOVAL EFFIVIENCY IN THE SPRAY TOWER. OXIDATION WAS FORCED IN THE VENTURI SLURRY HOLD TANK. UNDER TYPICAL OPERATING CONDITONS, THE OVERALL SO2 REMOVAL WAS 9[illegible] PERCENT AT 2300 PPM INLET SO2 CONCETRATION, COMPARED TO 86 PERCENT REMOVEL AT 16[illegible]0 PPM INLET SO2 WITHOUT MGO ADDITION. SO2 REMOVAL BY VENTURI ALONE WAS 30 PERCENT ABOUT THE SAME AS THE CASE WITHOUT MGO ADDITION. SO2 REMOVAL BY VENTURI ALONE WAS 30 PERCENT, ABOUT THE SAME AS THE CASE WITHOUT MGO ADDITION. NEAR COMPLETE SULFITE OXIDATION COULD BE ACHIEVED AT AN AIR STOICHIOMETRIC RATIO AS LOW AS 1.3 ATOMS OXYGEN/MOLE OF SO2 ABSORBED, IN THE SAME ORDER AS THE CASE WITHOUT MGO ADDITION.
FORCED OXDATION WAS ALSO CONDUCTED ON THE LIMESTONE SLURRY BLEED STREAM FROM THE VENTURI/SPRAY TOWER SYSTEM. A SINGLE EFFLUENT HOLD TANK WAS USED FOR BOTH VENTURI AND SPRAY TOWER. MGO WAS ADDED TO THE EFFLUENT HOLD TANK TO MAINTAIN AN EFFECTIVE MG++ ION CONCENTRATION OF 5000 PPM. A SLURRY STREAM WAS TAKEN FROM THE SCRUBBER DWONCOMER AND SETT TO AN OXIDATION TANK INTO WHICH AIR WAS SPARGED. A RECYCLE STREAM OF ABOUT 30 GPM WAS SENT BACK FROM THE OXIDATION TANK TO THE EFFLUENT HOLD TANK TO CONTROL PH IN THE OXIDATION TANK AND TO PROVIDE GYPSUM SEEDS IN THE SCRUBBER SLURRY FINAL SYSTEM BLEED WAS WITHDRAWN FROM THE OXIDATION TANK. AT AVERAGE OXIDATION TANK PH OF 6, SULFITE OXIDATION AVERAGED 98 PERCENT. FILTER CAKE SOLIDS CONTENT WAS 8[illegible] PERCENT, SIMILAR TO THAT OBTAINED WITH TWO SCRUBBER LOOP OPERATIONS. HOWEVER, THE SLURRY SOLIDS SETTLING RATE WAS ONLY ABOUT 0.4 CM/MIN, COMPARED TO ABOUT 0.8 CM/MIN FOR THE TWO LOOP OPERATION. SETTLING RATE FOR UNOXIDIZED SLURRY CONTAINING MAGNESIUM ION NORMALLY DID NOT EXCEED 0.1 CM/MIN WITH 50 TO 60 PERCENT FILTER CAKE SOLIDS.
TCA CONTINUED TO OPERATE WITH MGO ADDITION W ITH BOTH LIME AND LIMSTONE SCRUBBING.FLUE GAS WITH HIGH FLY ASH LOADING WAS USED. THE INTENT OF THESE TESTS WAS TO CLARIFY SOME OF THE INCONSISTANT RESULTS OBTAINED DURING EARLIER RUNS MADE IN APRIL-NOVEMBER 1976, DURING WHICH SCRUBBER DOWNCOMER AIR LEAKAGE WAS SUSPECTED IN SOME OF THE TESTS. IN GENERAL, TEST RUNS MADE IN 1976 HAD HIGHER SO2 CONCENTRATION, MOSTLY GREATER THAN 3000 PPM, WHILE THE RECENT RUNS HAD ONLY ABOUT 2500 PPM. AT THE HIGHER INLET SO2 AND THE HIGHER RESULTANT SO_2 MAKE-PER-PASS, THE 1976 TESTS OPERATED EITHER UNSATURATED OR SUPER SATURATED WITH RESPECT TO GYPSUM, DEPENDING ON THE SULFITE OXIDATION LEVEL. SEVERE GYPSUM SCALING OCCURRED WHEN THE OPERATION WAS UNDER GYPSUM-SATURATED MODE. IN THE RECENT RUNS, OPERATION WAS MOSTLY

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----------------------------------------PERFORMANCE DATA--------------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
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                        UNDER GYPSUM-SATURATED MODE. HOWEVER, BECAUSE OF THE LOWER INLET SO2 AND
                        LOWER SO2 MAKE-PER-PASS, THE GYPSUM SATURATION LEVELS WERE NOT HIGH ENOUGH
                        TO CAUSE ANY SIGNIFICANT SCALING.
              AFFECTED MODULES: SYSTEM

 5/78   SYSTEM                                                                  744

 6/78   SYSTEM                                                                  720

      ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    6/78      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE      7/78      COMMENTS: RESEARCH AND DEVELOPMENT
                        FORCED OXIDATION FEED STREAM FROM THE VENTUR2/SPRAY TOWER SYSTEM CONTINUED
                        THROUGH MID-JUNE. TWO TEST RUNS TWO TEST RUNS WERE MADE IN WH ICH MGO WAS
                        ADDED TO MAINTAIN AN EFFECTIVE MG++ CONCENTRATION OF 5000 PPM IN THE
                        SCRUBBER SLURRY AND NO RECYCLE STREAM WAS SENT BACK FROM THE OXIDATION
                        TANK (8 FT DIAMTER AND 18 FT TANK LEVEL) TO THE EFFLUENT HOLD TANK. AV-
                        ERAGE SULFITE OXIDATION WAS 96 % OR HIGHER AT AN AIR STOICHIOMETRIC RATIO
                        OF 1.6 ATOMS OXYGEN/MOLE SO2 ABSORBED.  THE OXIDATION TANK PH WAS 5.4 TO
                        5.6 ONLY 0.2 UNIT HIGHER THAN THE EFFLUENT HOLD TANK PH. THE FILTER CAKE
                        SOLIDS WAS 85 PERCENT AND THE SOLIDS SETTLING RATE WAS 0.4 TO 0.5 CM/MIN.
                        BOTH SCRUBBER SYSTEMS WERE SHUT DOWN FOR TWO WEEKS FROM JUNE 19 DUE TO A
                        BOILER OUTAGE SCHEDULED FOR RE-ROUTING THE FLUE GAS DUCT FROM THE 800 FT
                        STACK TO THE NO. 11 SMALL STACK.
                        FOLLOWING THE BOILER OUTAGE BOTH SCRUBBER SYSTEMS STARTED ON NEW LIME AND
                        LIMESTONE TEST BLOCKS IN WHICH ADIPIC ACID, AN ORGANIC PH BUFFER, WAS AD-
                        DED TO THE SCRUBBER SLURRY TO IMPROVE SO2 REMOVAL EFFICIENCY.
                        INITIAL TEST RUNS WERE CONDUCTED WITHOUT ADIPIC ACID ADDITION TO ESTABLISH
                        THE BASE CASE SO2 REMOVAL IN BOTH LIME AND LIMESTONE SCRUBBING FOR BOTH
                        SCRUBBER SYSTEMS. THE VENTURI/SPRAY TWOER SYSTEM WAS OPERATED WIT H TWO-
                        SCRUBBER-LOOP CONFIGURATION WITH FORCED OXIDATION IN THE FIRST LOOP WHILE
                        THE TCA WAS OPERATED IN A ONE-ONESCRUBBER-LOOP SCHEME WITHOUT FORCED
                        OXIDAT ION.
                        PRELIMINARY RESULTS SHOWED THAT 96 TO 99 PERCENT SO2 REMOVAL WAS CONSIS-
                        TANTLY ACHIEVED IN THE VENTUR/SPRAY TOWER SYSTEM OPERATING WITH ABOUT 1600
                        PPM AND 1400 PPM ADIPIC ACID IN THE VENTURI AND SPRAY TOWER RESPECTIVELY.
                        THESE SO2 REMOVALS COMPARE VERY FAVORABLY WITH T HE 66 PERCENT REMOVAL FOR
                        THE BASE CASE LIME RUN WITHOUT ADIPIC ACID. ON THE TCA SYSTEM, A LIME RUN
                        WITH ABOUT 400 PPM ADIPIC ACID GAVE ABOUT 80 PERCENT SO2 REMOVAL, COMPARED
                        TO 67 PERCENT FOR THE BASE CASE RUN.
              AFFECTED MODULES: SYSTEM

 7/78   SYSTEM                                                                  744

 8/78   SYSTEM                                                                  744

      ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    8/78      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE      9/78      COMMENTS: RESEARCH AND DEVELOPMENT
                        TESTING WITH ADIPIC ACID AS ADDITIVE FOR IMPROVING SO2 REMOVAL EFFICIENCY
                        CONTINUED THROUGH AUGUST AND DEPTEMBER. BOTH VENTURI/SPRAY TO WER AND TCA
                        SYSTEMS WERE OPERATED ON LIMESTONE SLURRY WITH HIGH FLY ASH LOADING DURING
                        THIS PERIOD. THE TCA WAS OPERATED WITHOUT FORCED OXIDATION AND THE VENTURI
                        SPRAY TOWER WITH TWO-SCRUBBER-LOOP FORCED OXIDATION. AS IN THE LIME TESTS
                        WITH ADIPIC ACID ADDITION CONDUCTED IN JULY SIGNIFICANT IMPROVEMENT IN SO2
                        REMOVAL EFFICIENCY WAS ALSO OBERWAS IN THE LIMSTONE TESTS. UNDER TYPICAL
                        OPERATION, SO2 REMOVAL  H IGHER THAN 90 PERCENT COULD BE ACHIEVED BY THE
                        VENTURI/SPRAY TOWER  WITH ABOUT 2100 PPM AND 1500 PPM ADIPIC AC ID IN THE
                        VENTURI AND SPRAY TOWER RESPECTIVELY. UNDER THE SHOE OPERATING CONDITONS
                        BUT WITHOUT ADIPIC ACID, THE SO2 REMOVAL WAS ONLY 57 PERCENT. THE SULFITE
                        OXIDATION EFFICIENCY AND WASTE SLUDGE DEWATERING PROPERTIES DID NOT APPEAR
                        TO BE AFFECTED BY THE PRESENCE OF ADIPIC ACID.
                        IN THE TCA, HIGHER THAN 90 PERCENT SO2 REMOVALS WERE OBTAINED WITH 750 TO
                        1500 PPM AD IPIC AC ID COMPARED TO 71 PERCENT REMOVAL FOR A BASE CASE RUN
                        WITHOUT ADIPIC ACID.
                        IN BOTH SCRUBBER SYSTEMS THE PH IN T HE SCRUBBER SLURRY NEEDS TO BE HIGHER
                        THAN ABOUT 5.0,THE UPPER PH BUFFER POINT OF ADIPIC ACID, FOR THIS ADDITIVE
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------------------------------------------PERFORMANCE DATA------------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                 SO2  PART. HOURS HOURS  HOURS FACTOR
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                            TO BE FULLY EFFECTIVE.
                            DETERIORATION OR DECOMPOSITION OF ADIPIC ACID APPARENTLY TAKES PLACE IN
                            THE SCRUBBER. ACTUAL FEED RATES OF ADIPIC ACID WERE 2 TO 3 TIMES HIGHER
                            THAN COULD BE ACCOUNTED FOR IN THE SYSTEM DISCHARGE SLUDGE.
                  AFFECTED MODULES: SYSTEM

  9/78  SYSTEM                                                              720

 10/78  SYSTEM                                                              744

        ** PROBLEMS/SOLUTIONS/COMMENTS
                  START DATE  10/78     EQUIPMENT: FGD SYSTEM, GENERAL
                  END DATE    11/78     COMMENTS: RESEARCH AND DEVELOPMENT
                            A ONE MONTH LONG-TERM RELIABILITY RUN WAS CONDUCTED ON BOTH THE VENTURI/
                            SPRAY TOWER AND TCA SYSTEMS USING LIMSTONE SLURRY WIT H ADIPIC ACID AS AN
                            ADDITIVE FOR ENHANCING SO2 REMOVAL EFFICIENCY. STEADY-STATE SO2 REMOVAL IN
                            BOTH RUNS WAS CONSISTANTLY HIGH IN THE RANGE OF 96 TO 99 PERCENT UNDER
                            TYPICAL OPERATING CONDITIONS. THE VENTURI/SPRAY TOWER SYSTEM WAS OPERATED
                            WITH TWO-SCRUBBER-LOOP FORCED OXIDATION. ADIPIC AC ID CONCENTRATIONS WERE
                            1500 PPM IN THE TCA AND THE SPRAY TOWER, AND 2400 PPM IN THE VENTURI. BOTH
                            SCRUBBER SYSTEMS OPERATED FREE OF SCALING AND PLUGGING
                            LONG-TERM TESTS BEGAN IN MID-NOVEMBER TO COMPARE CONVENTIONAL LIME SCRUB-
                            BING WITH ADVANCED LIMSTONE SCRUBBING USING CHEMICAL ADDITIVES AND FORCED
                            OXIDATION. EACH TEST WILL LAST ONE MONTH OR LONGER. THE VENTURI/SPRAY TOW-
                            ER SYSTEM IS BEING OPERATED WITH TWO-SCRUBBER-LOOP FORCED OXIDATION AND
                            LIMESTONE SLURRY AND ADIPIC ACID ADDITION. THE TCA SYSTEM IS BEING OPERAT-
                            ED WITH LIME SLURRY (NO ADDITIVES) AND WITHOUT FORCED OXIDATION. DURING
                            THESE TESTS CONTINUOUS SO2 EMISSIONS MONITORING PROCEDURES WILL BE
                            ASSESSED.
                  AFFECTED MODULES: SYSTEM

 11/78  SYSTEM                                                              720

 12/78  SYSTEM                                                              744

        ** PROBLEMS/SOLUTIONS/COMMENTS
                  START DATE  12/78     EQUIPMENT: FGD SYSTEM, GENERAL
                  END DATE     1/79     COMMENTS: RESEARCH AND DEVELOPMENT
                            LONG-TERM TESTS ON BOTH SCRUBBER SYSTEMS. WHICH BEGAN IN MID-NOVEMBER 1978
                            WERE COMPLETED NEAR THE END OF JANUARY 1979.  THESE TESTS WERE CONDUCTED
                            TO COMPARE CONVENTIONAL LIME SCRUBBING WITH ADVANCED LIMESTONE SCRUBBING
                            USING CHEMICAL ADDITIVES AND FORCED OXIDATION.  THE VENTURI/SPRAY TOWER
                            WAS OPERATED WITH TWO-SCRUBBER-LOOP FORCED OXIDATION AND WITH LIMESTONE
                            SLURRY AND ADIPIC ACID ADDITION.  THE TCA SYSTEM WAS OPERATED WITH LIME
                            SLURRY (NO ADDITIVE) AND WITHOUT FORCED OXIDATION.  DURING THESE TESTS
                            CONTINUOUS SO2 EMISSIONS MONITORING PROCEDURES WERE ASSESSED.
                  AFFECTED MODULES: SYS*

  1/79  SYSTEM                                                              744
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                                   SECTION 3
              DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
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 COMPANY NAME                                   TENNESSEE VALLEY AUTHORITY
 PLANT NAME                                     WIDOWS CREEK
 UNIT NUMBER                                    8
 CITY                                           BRIDGEPORT
 STATE                                          ALABAMA
 REGULATORY CLASSIFICATION                      C
 PARTICULATE EMISSION LIMITATION - NG/J           52.          (  .120 LB/MMBTU)
 SO2 EMISSION LIMITATION - NG/J                  516.          ( 1.200 LB/MMBTU)
 NET PLANT GENERATING CAPACITY - MW             *******
 GROSS UNIT GENERATING CAPACITY - MW              550.0
 NET UNIT GENERATING CAPACITY W/FGD - MW          516.0
 NET UNIT GENERATING CAPACITY WO/FGD - MW       *******
 EQUIVALENT SCRUBBED CAPACITY - MW                550.0

 ** BOILER DATA
     SUPPLIER                                   COMBUSTION ENGINEERING
     TYPE                                       BALANCED DRAFT, TANGENTIALLY FIRED
     SERVICE LOAD                               BASE
     COMMERCIAL SERVICE DATE                     0/63
     MAXIMUM BOILER FLUE GAS FLOW - CU.M/S        755.04       (1600000 ACFM)
     FLUE GAS TEMPERATURE - C                     137.8        ( 280 F)
     STACK HEIGHT - M                           ******         (**** FT)
     STACK TOP DIAMETER - M                     *******        (***** FT)

 ** FUEL DATA
     FUEL TYPE                                  COAL
     FUEL GRADE                                 ******
     AVERAGE HEAT CONTENT - KJ/KG                23260.        ( 10000 BTU/LB)
     RANGE HEAT CONTENT - BTU/LB                                ******
     AVERAGE ASH CONTENT - %                       25.00
     RANGE ASH CONTENT - %                      ******
     AVERAGE MOISTURE CONTENT - %                  10.00
     RANGE MOISTURE CONTENT - %                 ******
     AVERAGE SULFUR CONTENT - %                     4.30
     RANGE SULFUR CONTENT - %                   ******
     AVERAGE CHLORIDE CONTENT - %               ********
     RANGE CHLORIDE CONTENT - %                 ******
     FUEL FIRING RATE - M T/H                   *******        (*** TPH)
     FUEL FIRING RATE - MW                      *****

 ** ESP
     NUMBER                                      1
     SUPPLIER                                   KOPPERS
     PARTICULATE DESIGN REMOVAL EFFICIENCY - %    50.0

 ** PARTICULATE SCRUBBER
     NUMBER                                     4
     TYPE                                       VARIABLE THROAT VENTURI
     NUMBER OF STAGES                              1
     SHELL MATERIAL                             316L SS
     BOILER LOAD/SCRUBBER - %                     25.0
     L/G RATIO - LITER/CU.M                        1.3         (10.0 GAL/1000ACF)
     PRESSURE DROP - KPA                           1.2         (     5 IN-H2O)
     PARTICULATE INLET LOAD - G/CU.M              12.6         (  5.50 GR/SCF)
     PARTICULATE OUTLET LOAD - G/CU.M               .1         (  .030 GR/SCF)
     PARTICULATE DESIGN REMOVAL EFFICIENCY - %    99.5
     SO2 INLET CONCENTRATION - PPM              3440.000
     SO2 DESIGN REMOVAL EFFICIENCY - %            10.0

 ** FGD SYSTEM
     SALEABLE PRODUCT/THROWAWAY PRODUCT         THROWAWAY PRODUCT
     GENERAL PROCESS TYPE                       WET SCRUBBING
     PROCESS TYPE                               LIMESTONE
     SYSTEM SUPPLIER                            TENNESSEE VALLEY AUTHORITY
     DEVELOPMENT LEVEL                          FULL-SCALE
     NEW/RETROFIT                               RETROFIT
     PARTICULATE DESIGN REMOVAL EFFICIENCY - %    99.50
     SO2 DESIGN REMOVAL EFFICIENCY - %            80.00
     COMMERCIAL DATE                             1/78
     INITIAL START-UP                            5/77
     CONSTRUCTION INITIATION                     2/73
     CONTRACT AWARDED                            2/73

 ** ABSORBER
     NUMBER                                      3
     TYPE                                       MULTIGRID TOWER
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                                      SECTION 3
                 DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
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     INITIAL START UP                            5/77
     SUPPLIER                                   POLYCON
     NUMBER OF STAGES                               5
     DIMENSIONS                                 30 WIDE X 16 DEEP X 34 HIGH
     SHELL MATERIAL                             CARBON STEEL
     SHELL LINER MATERIAL                       RUBBER, 316L SS ON SLOPING SECTIONS
     INTERNAL MATERIAL                          316L SS GRIDS (BOTTOM, CENTER AND TOP);
     BOILER LOAD/ABSORBER - %                     25.0
     L/G RATIO - L/CU.M                            8.0         ( 60.0 GAL/1000ACF)
     PRESSURE DROP - KPA                            .5         ( 2.0 IN-H2O)
     SUPERFICAL GAS VELOCITY - M/SEC               3.7         ( 12.0 FT/S)
     PARTICULATE OUTLET LOAD- G/CU.M                .0         (  .020 GR/SCF)
     SO2 OUTLET CONTRATION - PPM                 650
     SO2 DESIGN REMOVAL EFFICIENCY - %            70.0

 ** ABSORBER
     NUMBER                                      1
     TYPE                                       MULTIGRID TOWER WITH PACKING
     INITIAL START UP                            5/77
     SUPPLIER                                   POLYCON
     NUMBER OF STAGES                               5
     DIMENSIONS                                 30 WIDE X 16 DEEP X 34 HIGH
     SHELL MATERIAL                             CARBON STEEL
     SHELL LINER MATERIAL                       RUBBER, 316L SS ON SLOPING SECTIONS
     INTERNAL MATERIAL                          316L SS GRIDS (BOTTOM, CENTER AND TOP); FRP (2ND
     BOILER LOAD/ABSORBER - %                     25.0
     L/G RATIO - L/CU.M                            8.0         ( 60.0 GAL/1000ACF)
     PRESSURE DROP - KPA                            .5         ( 2.0 IN-H2O)
     SUPERFICAL GAS VELOCITY - M/SEC               3.7         ( 12.0 FT/S)
     PARTICULATE OUTLET LOAD - NG/J                9.          (  .020 LB/MMBTU)
     SO2 OUTLET CONTRATION - PPM                 650
     SO2 DESIGN REMOVAL EFFICIENCY - %            70.0

 ** FANS
     NUMBER                                      4
     TYPE                                       BOILER I.D.

 ** MIST ELIMINATOR
     NUMBER                                      4
     TYPE                                       CHEVRON
     CONSTRUCTION MATERIAL                      316L SS
     CONFIGURATION                              VERTICAL
     NUMBER OF PASSES                               4
     DEPTH - M                                      .30        ( 1.0 FT)
     VANE SPACING - CM                             3.8         ( 1.50 IN)
     WASH SYSTEM                                CONTINUOUS
     SUPERFICIAL GAS VELOCITY - M/S                2.7         (  9.0 FT/S)

 ** PROCESS CONTROL CHEMISTRY
     CONTROL VARIABLES                          PH, PRESSURE CHANGE, OUTLET SO2
     SENSOR LOCATION                            PH-ABSORBER RECYCLE LINE

 ** PUMPS
     SERVICE                                    NUMBER
     -------                                    ------
     ABSORBER RECIRCULATION PUMPS                 10
     VENTURI RECIRCULATION PUMPS                   4
     VENTURI RECIRCULATION PUMPS (SPARE)           2
     LIMESTONE SLURRY FEED PUMPS                ****
     POND WATER RETURN PUMPS                    ****

 ** TANKS
     SERVICE                                    NUMBER
     -------                                    ------
     ABSORBER RECIRCULATION TANK                   4
     VENTURI RECIRCULATION TANKS                   4
     LIMESTONE SLURRY STORAGE                      1
     RECIRC TNK UNDRFLW SURGE TANK                 1

 ** REHEATER
     TYPE                                       INDIRECT HOT AIR
     HEATING MEDIUM                             STEAM
     TEMPERATURE BOOST - C                        27.8         (   50 F)
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 ** REAGENT PREPARATION EQUIPMENT
     NUMBER OF BALL MILLS                                      1
     BALL MILL CAPACITY- M T/H                              45.3         ( 50.0 TPH)

 ** DISPOSAL
     NATURE                                             FINAL
     TYPE                                               POND
     DIMENSIONS                                         110 ACRES X 30 FT DEEP
     AREA - ACRES                                         110.0
     CAPACITY - CU.M                                      4035900      (  3300.0 ACRE-FT)


------------------------------------------PERFORMANCE DATA--------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

 8/77   8A
        8B
        8C
        8D
        SYSTEM      26.0        30.0        30.0        26.0                    744   657      0

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    8/77      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE      8/77      COMMENTS:
                           TVA HAS HAD EXTENSIVE PROBLEMS WITH START-UP OF ITS SCRUBBER FACILITY.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    8/77      EQUIPMENT: FAN
             END DATE      8/77      PROBLEM: CHEMICAL-RELATED EROSION
                           THERE HAVE BEEN EROSION PROBLEMS WITH THE I.D. FAN BLADES.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    8/77      EQUIPMENT: FAN
             END DATE      8/77      PROBLEM: MECHANICAL-RELATED COMPONENT INEFFICIENCY
                           THE FAN DRIVE MOTORS HAVE ALSO BEEN TROUBLESOME.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    8/77      EQUIPMENT: GAS DAMPER
             END DATE      8/77      PROBLEM: MECHANICAL-RELATED COMPONENT FAILURE
                           THE GUILLOTINE DAMPERS ARE INOPERABLE DUE TO JAMMED GEAR BOXES.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    8/77      EQUIPMENT: GAS DAMPER
             END DATE      8/77      PROBLEM: CHEMICAL-RELATED EROSION
                           THE SEALS AROUND THE DAMPERS HAVE CORRODED, CAUSING LEAKAGE OF THE FLUE
                           GAS AND PARTICULATE.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    8/77      EQUIPMENT: ABSORBER
             END DATE      8/77      PROBLEM: NOT DEFINED/SPECIFIED
                           THE RUBBER LINING IN THE ABSORBER SECTION OF ALL FOUR TRAINS HAS DETACHED
                           IN VARIOUS PLACES. THE VENDOR HAS REPAIRED THE DEFECTIVE SECTIONS.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    8/77      EQUIPMENT: INSTRUMENTATION
             END DATE      8/77      PROBLEM: NOT DEFINED/SPECIFIED
                           INSTRUMENTATION HAS BEEN A SERIOUS PROBLEM AREA.
             AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    8/77      EQUIPMENT: REAGENT HANDLING
             END DATE      8/77      PROBLEM: NOT DEFINED/SPECIFIED
                           THE BALL MILL IS ONLY ABLE TO PRODUCE 35 TPH OF LIMESTONE SLURRY OUT OF
                           IT'S 50 TPH CAPACITY.
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---------------------------------------------PERFORMANCE DATA-------------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
              AFFECTED MODULES: SYSTEM

 9/77   8A
        8B
        8C
        8D
        SYSTEM       75.0         71.0         71.0         60.0                  720   609      0

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    9/77      EQUIPMENT: BOILER-RELATED
              END DATE      9/77      COMMENTS:
                                      DURING THIS MONTH THE BOILER WAS OPERATED AT A REDUCED LOAD OF ABOUT
                                      300 MW. AT THIS REDUCED LOAD, ONLY 3 TRAINS WERE REQUIRED TO HANDLE
                                      ALL OF THE BOILER FLUE GAS.
              AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    9/77      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE      9/77      PROBLEM: CHEMICAL-RELATED SCALING
                                      SOME SCALING WAS DISCOVERED IN THE ABSORBER COLUMN AND ENTRAINMENT
                                      SEPARATOR OUTLET OF ONE TRAIN.
              AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    9/77      EQUIPMENT: FAN
              END DATE      9/77      PROBLEM: CHEMICAL-RELATED EROSION
                                      SERIOUS EROSION PROBLEMS CONTINUE WITH THE I.D. FAN ROTORS.
              AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE    9/77      EQUIPMENT: BOILER-RELATED
              END DATE      9/77      PROBLEM: NOT DEFINED/SPECIFIED
                                      THE UNIT WENT OFF LINE SEPTEMBER 30 FOR A SCHEDULED OUTAGE TO REPAIR BOIL-
                                      ER TUBES.DURING THE OUTAGE, AN ATTEMPT WILL BE MADE TO CORRECT MANY OF THE
                                      MECHANICAL PROBLEMS.
              AFFECTED MODULES: SYSTEM

10/77   SYSTEM                                                                    744

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   10/77      EQUIPMENT: BOILER-RELATED
              END DATE     10/77      PROBLEM: NOT DEFINED/SPECIFIED
                                      UNIT 8 WAS OFFLINE FOR THE ENTIRE MONTH DURING  SCHEDULED OUTAGE FOR
                                      REPAIR OF BOILER TUBES. DURING THIS PERIOD, MANY MECHANICAL AND INSTRUMEN-
                                      TAL SCRUBBER PROBLEMS WERE CORRECTED.
              AFFECTED MODULES: SYSTEM

11/77   8A
        8B
        8C
        8D
        SYSTEM       86.0         88.0         88.0         50.0                  720   413      0

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   11/77      EQUIPMENT: FGD SYSTEM, GENERAL
              END DATE     11/77      COMMENTS:
                                      THE UNIT WAS BROUGHT BACK IN SERVICE ON NOVEMBER 11 FOLLOWING THE SCHED-
                                      ULED BOILER OUTAGE (AVAILABILITY WAS CALCUATED FROM NOVEMBER 11 THROUGH
                                      NOVEMBER 30).
              AFFECTED MODULES: SYSTEM

        ** PROBLEMS/SOLUTIONS/COMMENTS
              START DATE   11/77      EQUIPMENT:
              END DATE     11/77      COMMENTS:
                                      ALL I.D. FANS HAVE BEEN REBUILT IN AN ATTEMPT TO CORRECT THE CORROSION AND
                                      DRIVE MOTOR PROBLEMS.
              AFFECTED MODULES: SYSTEM
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------------------------------------------PERFORMANCE DATA----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                 SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/77      EQUIPMENT: GAS DAMPER
            END DATE    11/77      PROBLEM: CHEMICAL-RELATED EROSION
                          GAS LEAKAGE FROM THE DAMPERS WAS CORRECTED BY WELDING A COVER PLATE OVER
                          THE SEAL DOORS. THE VENDOR IS CURRENTLY WORKING ON A NEW DESIGN FOR THE
                          DAMPERS.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  11/77      EQUIPMENT: INSTRUMENTATION
            END DATE    11/77      COMMENTS:
                          ALMOST ALL INSTRUMENTATION PROBLEMS CONTINUE TO HAMPER PROPER SCRUBBER
                          OPERATION.
            AFFECTED MODULES: SYSTEM

12/77  8A
       8B
       8C
       8D
       SYSTEM       56.0        97.0        59.0        56.0                     744   426      0

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/77      EQUIPMENT: BOILER-RELATED
            END DATE    12/77      PROBLEM: NOT DEFINED/SPECIFIED
                          THE UNIT WAS OFF-LINE FROM DECEMBER 20 - DECEMBER 31 FOR REPAIRS OF A
                          BOILER TUBE LEAK.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/77      EQUIPMENT: SCRUBBER
            END DATE    12/77      COMMENT: PREVENTIVE MAINTENANCE
                          DURING THIS OUTAGE, AN INSPECTION WAS MADE OF THE SCRUBBER MODULES.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  12/77      EQUIPMENT: SCRUBBER
            END DATE    12/77      PROBLEM: NOT DEFINED/SPECIFIED
                          THE RUBBER LINER WAS FOUND TO BE MISSING IN SEVERAL AREAS OF ALL FOUR
                          MODULES AND WAS REPAIRED DURING THE OUTAGE.
            AFFECTED MODULES: SYSTEM

 1/78  8A
       8B
       8C
       8D
       SYSTEM       88.0        96.0        96.0        79.0                     744   618      0

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/78      EQUIPMENT: SCRUBBER
            END DATE     1/78      PROBLEM: NOT DEFINED/SPECIFIED
                          ALL FOUR SCRUBBER MODULES RETURNED TO SERVICE THIS MONTH FOLLOWING REPAIR
                          WORK ON THE RUBBER LINER.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/78      EQUIPMENT: PIPING
            END DATE     1/78      PROBLEM: NOT DEFINED/SPECIFIED
                          THERE HAVE BEEN MINOR PROBLEMS  WITH COOLING LINES FREEZING AND BURSTING.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   1/78      EQUIPMENT: REAGENT HANDLING
            END DATE     1/78      PROBLEM: PLUGGING, OTHER
                          FEED HOPPERS AT THE LIMESTONE STORAGE AREA HAVE BEEN PLUGGING DUE TO FROZ-
                          EN GRAVEL.
            AFFECTED MODULES: SYSTEM
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-----------------------------------------PERFORMANCE DATA------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART.  HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    1/78      EQUIPMENT: REAGENT HANDLING
            END DATE      1/78      PROBLEM: CHEMICAL-RELATED EROSION
                                    THE BALL MILL SUMP PUMP LINER HAVE BEEN WEARING OUT.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    1/78      EQUIPMENT: SPRAY NOZZLES
            END DATE      1/78      PROBLEM: CHEMICAL-RELATED PLUGGING
                                    SOME PLUGGING OF THE VENTURI SPRAY NOZZLES WAS ENCOUNTERED.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    1/78      EQUIPMENT: INSTRUMENTATION
            END DATE      1/78      PROBLEM: NOT DEFINED/SPECIFIED
                                    INSTRUMENTATION CONTINUES TO BE A MAJOR PROBLEM WITH OPERATION OF THE
                                    SCRUBBER.
            AFFECTED MODULES: SYSTEM

 2/78  8B
       8C
       8D
       8A
       SYSTEM     55.0        54.0        61.0        47.0                        672   586     0

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    2/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE      2/78      COMMENTS:
                                       THE UTILITY COMPANY REPODRTED THAT THEY COULD NOT ACCURATELY DETERMINE
                                    RELIABILITY BECAUSE OF THEIR INABILITY TO CALCULATE UNIT LOAD DEMAND ON A
                                    DAILY BASIS. GENERALLY, IT IS ASSUMED THAT SYSTEM FORCED OUTAGE HOURS PLUS
                                    THE HOURS THE FGD SYSTEM WAS OPERATED WILL GIVE ROUGLY THE HOURS THE SYS-
                                    TEM WAS CALLED UPON TO OPERATE, IN THIS WAY, RELIABILITY CAN BE CALCULATED
                                    INDIRECTLY, HOWEVER, IN THIS CASE,TWO TRAINS AT A TIME HAVE BEEN DOWN ON A
                                    SCHEDULED OUTAGE FOR NECESSARY MODIFICATIONS. PART OF THIS OUTAGE TIME
                                    LIMITED BOILER OPERATION SO THAT THE UNIT COULD NOT RUN AT FULL LOAD WHEN
                                    THERE WAS DEMAND FOR A FULL LOAD. FOR THIS CALCULATION IT WAS ASSUMED THAT
                                    THERE WAS A DEMAND FOR FULL LOAD DURING THE ENTIRE OUTAGE SO THAT ALL OF
                                    THE TRAINS WOULD HAVE BEEN CALLED THE ENTIRE SCHEDULED OUTAGE.  THE RESULT
                                    WAS A VERY CONSERVATIVE ESTIMATE OF RELIABILITY WHERE HOURS CALLED=SYSTEM
                                    FORCED OUTAGE TIME & SYSTEM SCHEDULED OUTAGE TIME & HOURS THE FGD SYSTEM
                                  OPERATED.
                                       NOTE - THIS IS A PEDCO ESTIMATE.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    2/78      EQUIPMENT: DUCTWORK
            END DATE      2/78      PROBLEM: NOT DEFINED/SPECIFIED
                                    THE OUTAGE TIME FOR TRAINS A AND B WAS REQUIRED TO REPLACE THE RUBBER
                                    LINERS IN THE DOWNCOMER AREA WITH STAINLESS STEEL. THE OTHER TWO TRAINS
                                    WILL RECIEVE SIMILAR TREATMENT.
            AFFECTED MODULES: SYSTEM

 3/78  8A
       8B
       8C
       8D
       SYSTEM     60.0        66.0        59.0        58.0                        744   644     0

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    3/78      EQUIPMENT: DUCTWORK
            END DATE      3/78      PROBLEM: NOT DEFINED/SPECIFIED
                                    TRAIN B WAS OUT OF SERVICE MARCH 1-MARCH 13 TO INSTALL STAINLESS STEEL IN
                                    THE ABSORBER AND VENTURI DOWN COMER AREAS.
            AFFECTED MODULES: 8B
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-----------------------------------------PERFORMANCE DATA-----------------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   3/78      EQUIPMENT: EXPANSION JOINT
            END DATE     3/78      PROBLEM: NOT DEFINED/SPECIFIED
                         STAINLESS STEEL COVERS WERE INSTALLED AROUND TWO EXPANSION JOINTS ON TRAIN
                         C IN ORDER TO PREVENT FLUE GAS LEAKAGE.
            AFFECTED MODULES: 8C

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   3/78      EQUIPMENT: GAS DAMPER
            END DATE     3/78      PROBLEM: NOT DEFINED/SPECIFIED
                         A STAINLESS STEEL PLATE WAS WELDED OVER THE ENTRY DOOR OPENINGS TO TRAIN C
                         OUTLET AND BYPASS GUILLOTINE DAMPERS FOR THE PURPOSE OF ELIMINATING GAS
                         LEAKAGE.
            AFFECTED MODULES: 8C

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   3/78      EQUIPMENT: DUCTWORK
            END DATE     3/78      PROBLEM: NOT DEFINED/SPECIFIED
                         TRAIN C WAS OUT OF SERVICE MARCH 14 - 29 TO INSTALL STAINLESS STEEL IN THE
                         ABSORBER AND VENTURI DOWNCOMER AREAS.
            AFFECTED MODULES: 8C

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   3/78      EQUIPMENT: REAGENT HANDLING
            END DATE     3/78      PROBLEM: NOT DEFINED/SPECIFIED
                         SEVERAL LIFTER BARS ON THE FEED AND DISCHARGE ENDS OF THE BALL MILL WERE
                         FOUND TO BE BADLY WORN.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   3/78      EQUIPMENT: TRANSFER PUMP
            END DATE     3/78      PROBLEM: CHEMICAL-RELATED EROSION
                         THE UTILITY HAS HAD WEAR PROBLEMS WITH THE SLURRY SUMP PUMP LINERS AT THE
                         BALL MILL.
            AFFECTED MODULES: SYSTEM

 4/78  8A
       8B
       8C
       8D
       SYSTEM      69.0         83.0         67.0         62.0                           720   540      0

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   4/78      EQUIPMENT: MIST ELIMINATOR
            END DATE     4/78      PROBLEM: CHEMICAL-RELATED PLUGGING
                         DURING A BRIEF INSPECTION OF THE SCRUBBING SYSTEM IN EARLY APRIL, SOLIDS
                         DEPOSITION WAS NOTICED IN THE MIST ELIMINATOR SECTION OF ALL TRAINS DUE TO
                         PLUGGING THAT HAD OCCURRED IN SEVERAL OF THE MIST ELIMINATOR SPRAY NOZZLES
                         TRAIN D WAS NOT IN OPERATION FOR 17 DAYS WHILE THE MIST ELIMINATOR WAS
                         DISASSEMBLED AND CLEANED.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   4/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     4/78      PROBLEM: NOT DEFINED/SPECIFIED
                         A STAINLESS STEEL LINER WAS INSTALLED ON THE SLOPING SECTIONS OF THE
                         ABSORBER AND VENTURI.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   4/78      EQUIPMENT: GAS DAMPER
            END DATE     4/78      PROBLEM: NOT DEFINED/SPECIFIED
                         STAINLESS STEEL PLATES WERE INSTALLED OVER THE ENTRY DOOR OPENINGS TO TRAI
                         D INLET, OUTLET AND BYPASS GUILLOTINE DAMPERS TO REDUCE GAS LEAKAGE.
            AFFECTED MODULES: 8D
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-------------------------------------------PERFORMANCE DATA-----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL    PER BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ----- ----- ------

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   4/78      EQUIPMENT: EXPANSION JOINT
             END DATE     4/78      PROBLEM: NOT DEFINED/SPECIFIED
                          STAINLESS STEEL COVERS WERE INSTALLED AROUND THE FIVE EXPANSION JOINTS ON
                          TRAIN D, TWO EXPANSION JOINTS ON TRAIN A, AND ONE EXPANSION JOINT ON TRAIN
                          B TO REDUCE GAS LEAKAGE.
             AFFECTED MODULES: BA     BB     BD

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   4/78      EQUIPMENT: TRANSFER PUMP
             END DATE     4/78      PROBLEM: CHEMICAL-RELATED EROSION
                          THERE CONTINUES TO BE A WEAR PROBLEM WITH PUMP LINERS AT THE BALL MILL. NO
                          CAUSE OR SOLUTION OF THE PROBLEM HAS BEEN ASCERTAINED AS YET.
             AFFECTED MODULES: SYSTEM

 5/78  SYSTEM                                                                 744

 6/78  SYSTEM                                                                 720

 7/78  SYSTEM                                                                 744

 8/78  SYSTEM                                                                 744

 9/78  SYSTEM                                                                 720

10/78  SYSTEM                                                                 744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/78      EQUIPMENT: BOILER-RELATED
             END DATE     1/79      COMMENT: PREVENTIVE MAINTENANCE SCHEDULED UNIT OUTAGE
                          THE BOILER WENT OFF LINE IN EARLY OCTOBER FOR BOILER OVERHAUL.  THE UNIT
                          RESTARTED FOR A FEW DAYS IN DECEMBER UNTILL A TURBINE ROTOR PROBLEM
                          WAS DISCOVERED. THE PROBLEM FORCED THE UNIT OFF LINE THROUGH JANUARY.
             AFFECTED MODULES: SYSTEM

11/78  SYSTEM                                                                 720

12/78  SYSTEM                                                                 744

 1/79  SYSTEM                                                                 744
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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 COMPANY NAME                                    TEXAS UTILITIES
 PLANT NAME                                      MARTIN LAKE
 UNIT NUMBER                                     1
 CITY                                            TATUM
 STATE                                           TEXAS
 REGULATORY CLASSIFICATION                       A
 PARTICULATE EMISSION LIMITATION - NG/J            43.          (  .100 LB/MMBTU)
 SO2 EMISSION LIMITATION - NG/J                   516.          ( 1.200 LB/MMBTU)
 NET PLANT GENERATING CAPACITY - MW              3000.0
 GROSS UNIT GENERATING CAPACITY - MW              793.0
 NET UNIT GENERATING CAPACITY W/FGD - MW          750.0
 NET UNIT GENERATING CAPACITY WO/FGD - MW       *******
 EQUIVALENT SCRUBBED CAPACITY - MW                595.0

 ** BOILER DATA
    SUPPLIER                                     COMBUSTION ENGINEERING
    TYPE                                         PULVERIZED COAL
    SERVICE LOAD                                 BASE
    COMMERCIAL SERVICE DATE                       0/77
    MAXIMUM BOILER FLUE GAS FLOW - CU.M/S         1494.51       (3167000 ACFM)
    FLUE GAS TEMPERATURE - C                       168.3        ( 335 F)
    STACK HEIGHT - M                             ******         (**** FT)
    STACK TOP DIAMETER - M                       *******        (***** FT)

 ** FUEL DATA
    FUEL TYPE                                    COAL
    FUEL GRADE                                   LIGNITE
    AVERAGE HEAT CONTENT - KJ/KG                  17166.        (  7380 BTU/LB)
    RANGE HEAT CONTENT - BTU/LB                                   ******
    AVERAGE ASH CONTENT - %                          8.00
    RANGE ASH CONTENT - %                        ******
    AVERAGE MOISTURE CONTENT - %                    33.00
    RANGE MOISTURE CONTENT - %                   ******
    AVERAGE SULFUR CONTENT - %                        .90
    RANGE SULFUR CONTENT - %                     ******
    AVERAGE CHLORIDE CONTENT - %                 ********
    RANGE CHLORIDE CONTENT - %                   ******
    FUEL FIRING RATE - M T/H                       453.5        (500 TPH)
    FUEL FIRING RATE - MW                        *****

 ** ESP
    TYPE                                         COLD SIDE

 ** FGD SYSTEM
    SALEABLE PRODUCT/THROWAWAY PRODUCT           THROWAWAY PRODUCT
    GENERAL PROCESS TYPE                         WET SCRUBBING
    PROCESS TYPE                                 LIMESTONE
    SYSTEM SUPPLIER                              RESEARCH COTTRELL
    DEVELOPMENT LEVEL                            FULL-SCALE
    NEW/RETROFIT                                 NEW
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %       99.40
    SO2 DESIGN REMOVAL EFFICIENCY - %               71.00
    COMMERCIAL DATE                               8/77
    INITIAL START-UP                              4/77

 ** ABSORBER
    NUMBER                                        6
    TYPE                                         PACKED SPRAY TOWER
    INITIAL START UP                              4/77
    SUPPLIER                                     RESEARCH COTTRELL
    NUMBER OF STAGES                                3
    DIMENSIONS                                   28 DIA. X 100 TALL
    BOILER LOAD/ABSORBER - %                        12.5
    GAS FLOW - CU.M/S                              177.13       ( 375350 ACFM)
    GAS TEMPERATURE - C                            162.8        (  325 F)

 ** CENTRIFUGE
    NUMBER                                        3
    OUTLET SOLIDS - %                               69.0

 ** FANS
    NUMBER                                        4
    TYPE                                         BOILER I.D.
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** MIST ELIMINATOR
    NUMBER                                          12
    TYPE                                            CHEVRON

** REHEATER
    TYPE                                            BY PASS
    TEMPERATURE BOOST - C                             40.0        (  72 F)

** THICKENER
    NUMBER                                           1
    TYPE                                            GRAVITY
    DIAMETER - M                                      42.7        (140 FT)
    OUTLET SOLIDS - %                                 35.0

** WATER LOOP
    TYPE                                            CLOSED
    FRESH MAKEUP WATER ADDITION - LITERS/S            34.6        (  550 GPM)

** TREATMENT
    TYPE                                            FLYASH STABILIZED
    SUPPLIER                                        NONPROPRIETARY
    PRODUCT CHARACTERISTICS                         CENTRIFUGE SOLIDS MIXED WITH FLY ASH

** DISPOSAL
    NATURE                                          FINAL
    TYPE                                            LANDFILL
    LOCATION                                        ON-SITE
    TRANSPORTATION                                  RAIL


------------------------------------------PERFORMANCE DATA-----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

 8/77  SYSTEM                                                              744

 9/77  SYSTEM                                                              720

10/77  SYSTEM                                                              744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/77     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     1/78     COMMENTS:
                          INSTALLATION OF THE LIMESTONE SCRUBBING SYSTEM AND THE ESP WAS COMPLETED
                          BY OCTOBER 1977.  THE INITIAL OPERATING PHASE IS EXPECTED TO CONTINUE
                          THROUGH THE FIRST QUARTER OF 1978.  COMPLIANCE TESTING  WAS CONDUCTED IN
                          LATE 1977 AND CERTIFICATION OF COMMERCIAL AVAILABILITY IS AWAITED.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE  10/77     EQUIPMENT: REAGENT HANDLING
            END DATE     1/78     PROBLEM: NOT DEFINED/SPECIFIED
                          THE UTILITY EXPERIENCED SOME DIFFICULTIES IN THE SLURRY HANDLING SYSTEM.
            AFFECTED MODULES: SYSTEM

11/77  SYSTEM                                                              720

12/77  SYSTEM                                                              744

 1/78  SYSTEM                                                              744

 2/78  SYSTEM                                                              672

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   2/78     EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     3/78     COMMENTS:
                          CERTIFICATION WAS RECIEVED FROM THE EPA DURING THE PERIOD.  THE BOILER AND
                         FGD SYSTEM OPERATED THROUGHOUT THE PERIOD.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   2/78     EQUIPMENT: REAGENT HANDLING
            END DATE     3/78     PROBLEM: NOT DEFINED/SPECIFIED
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---------------------------------------PERFORMANCE DATA-----------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------
                        THE UTILITY IS STILL HAVING SOME PROBLEMS WITH THE SLURRY HANDLING SYSTEM.
                        SOME FORCED OUTAGE TIME OCCURRED.
                AFFECTED MODULES: SYSTEM

 3/78  SYSTEM                                                                 744

 4/78  SYSTEM                                                                 720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    4/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE      5/78      COMMENTS:
                          THE UNIT WAS TAKEN OFF LINE IN APRIL FOR AN ANNUAL TWO WEEK OUTAGE.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    4/78      EQUIPMENT: BOILER-RELATED
            END DATE      5/78      COMMENTS:
                          GENERATOR PROBLEMS WERE ENCOUNTERED IN MAY CAUSING THE UNIT TO BE TAKEN
                          OFF LINE THROUGH THE END OF THE MONTH.
            AFFECTED MODULES: SYSTEM

 5/78  SYSTEM                                                                 744

 6/78  SYSTEM                                                                 720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    6/78      EQUIPMENT: GAS DAMPER
            END DATE      7/78      PROBLEM: NOT DEFINED/SPECIFIED
                          THE DAMPERS FOR EACH ABSORBER MODULE WERE NOT FUNCTIONING PROPERLY.  IT
                          HAS BEEN IMPOSSIBLE TO ISOLATE INDIVIDUAL MODULES FOR REPAIRS (THE ENTIRE
                          SYSTEM WOULD HAVE TO BE SHUT DOWN IF REPAIRS WERE REQUIRED ON ONLY ONE
                          MODULE).
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    6/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE      7/78      COMMENTS:
                          THE UNIT IS OPERATING COMMERCIALLY.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    6/78      EQUIPMENT: PROCESS CONTROL
            END DATE      7/78      PROBLEM: NOT DEFINED/SPECIFIED
                          THERE HAVE BEEN PROBLEMS WITH THE PH METERS.  THE METERS HAVE NOT OPERATED
                          PROPERLY FOR SOME TIME NOW.
            AFFECTED MODULES: SYSTEM

 7/78  SYSTEM                                                                 744

 8/78  SYSTEM                                                                 744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    8/78      EQUIPMENT: GAS DAMPER
            END DATE      9/78      PROBLEM: NOT DEFINED/SPECIFIED
                          ISOLATION DAMPER PROBLEMS CONTINUED.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    8/78      EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE      9/78      COMMENTS:
                          THE UNIT CONTINUES TO REQUIRE EXCESSIVE MAINTENANCE.  FGD SYSTEM ACCEPT-
                          ANCE TEST WERE PERFORMED BY THE UTILITY DURING AUGUST.  RESULTS ARE NOT
                          YET AVAILABLE.
            AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE    8/78      EQUIPMENT: INSTRUMENTATION
            END DATE      9/78      PROBLEM: NOT DEFINED/SPECIFIED
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-------------------------------------------PERFORMANCE DATA-------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
                       FLOW MEASUREMENT INSTRUMENTATION HAS BEEN FAILING.
          AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE   8/78      EQUIPMENT: ESP
          END DATE     9/78      COMMENTS:
                       OPACITY HAS BEEN HIGHER THAN EXPECTED (20-25%) RESULTING FROM ESP PROB-
                       LEMS.
          AFFECTED MODULES: SYSTEM

  9/78  SYSTEM                                                                  720

 10/78  SYSTEM                                                                  744

      ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  10/78      EQUIPMENT: FGD SYSTEM, GENERAL
          END DATE    11/78      COMMENTS:
                       NO PROBLEMS HAVE BEEN REPORTED.
          AFFECTED MODULES: SYSTEM

 11/78  SYSTEM                                                                  720

 12/78  SYSTEM                                                                  744

      ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  12/78      EQUIPMENT: SLUDGE DISPOSAL
          END DATE     1/79      PROBLEM: NOT DEFINED/SPECIFIED
                       THE FGD SYSTEM WAS SHUT DOWN WHILE THE BOTTOM ASH POND WAS CLEANED OUT.
                       THE UTILITY HAS BEEN DUMPING SLUDGE INTO THE POND WHICH WAS DESIGNED FOR
                       BOTTOM ASH ONLY.  ALSO SLUDGE IS PRODUCED FASTER THAN IT IS REMOVED BY RAI
                       CAR.  THE UTILITY IS NOT GETTING RAIL CARS FAST ENOUGH.  THE ACTUAL
                       PROBLEM IS REPORTEDLY IN THE DEWATERING SYSTEM.
          AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  12/78      EQUIPMENT: MIST ELIMINATOR
          END DATE     1/79      PROBLEM: NOT DEFINED/SPECIFIED
                       SOME MIST ELIMINATOR WASH PROBLEMS WERE ENCOUNTERED.
          AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  12/78      EQUIPMENT: FGD SYSTEM, GENERAL
          END DATE     1/79      COMMENTS:
                       THE FGD SYSTEM HAS REPORTEDLY RAN WELL DURING DECEMBER AND JANUARY.
          AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  12/78      EQUIPMENT: BOILER-RELATED
          END DATE     1/79      PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                       COAL HANDLING WAS A SERIOUS PROBLEM DUE TO FREEZING OF THE COAL IN THE
                       HOPPERS.  THIS PROBLEM EFFECTED ALL UNITS AT MARTIN LAKE FORCING THE GAS
                       AND OIL UNITS TO CARRY THE LOAD.
          AFFECTED MODULES: SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
          START DATE  12/78      EQUIPMENT: FGD SYSTEM, GENERAL
          END DATE     1/79      COMMENTS:
                       THE SCRUBBING SYSTEM WAS SHUT DOWN FOR A TIME DURING THE REPORT PERIOD.
          AFFECTED MODULES: SYSTEM

  1/79  SYSTEM                                                                  744
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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COMPANY NAME                                      TEXAS UTILITIES
PLANT NAME                                        MARTIN LAKE
UNIT NUMBER                                       2
CITY                                              TATUM
STATE                                             TEXAS
REGULATORY CLASSIFICATION                         A
PARTICULATE EMISSION LIMITATION - NG/J              43.         (  .100 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                     516.         ( 1.200 LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW                3000.0
GROSS UNIT GENERATING CAPACITY - MW                793.0
NET UNIT GENERATING CAPACITY W/FGD - MW            750.0
NET UNIT GENERATING CAPACITY WO/FGD - MW        *******
EQUIVALENT SCRUBBED CAPACITY - MW                  595.0

** BOILER DATA
     SUPPLIER                                     COMBUSTION ENGINEERING
     TYPE                                         PULVERIZED COAL
     SERVICE LOAD                                 BASE
     COMMERCIAL SERVICE DATE                       0/78
     MAXIMUM BOILER FLUE GAS FLOW - CU.M/S         1494.51      (3167000 ACFM)
     FLUE GAS TEMPERATURE - C                       168.3       ( 335 F)
     STACK HEIGHT - M                             ******        (**** FT)
     STACK TOP DIAMETER - M                       *******       (***** FT)

** FUEL DATA
     FUEL TYPE                                    COAL
     FUEL GRADE                                   LIGNITE
     AVERAGE HEAT CONTENT - KJ/KG                  17166.       (  7380 BTU/LB)
     RANGE HEAT CONTENT - BTU/LB                                 ******
     AVERAGE ASH CONTENT - %                           8.00
     RANGE ASH CONTENT - %                        ******
     AVERAGE MOISTURE CONTENT - %                     33.00
     RANGE MOISTURE CONTENT - %                   ******
     AVERAGE SULFUR CONTENT - %                         .90
     RANGE SULFUR CONTENT - %                     ******
     AVERAGE CHLORIDE CONTENT - %                 ********
     RANGE CHLORIDE CONTENT - %                   ******
     FUEL FIRING RATE - M T/H                       453.5       (500 TPH)
     FUEL FIRING RATE - MW                        *****

** ESP
     TYPE                                         COLD SIDE

** FGD SYSTEM
     SALEABLE PRODUCT/THROWAWAY PRODUCT           THROWAWAY PRODUCT
     GENERAL PROCESS TYPE                         WET SCRUBBING
     PROCESS TYPE                                 LIMESTONE
     SYSTEM SUPPLIER                              RESEARCH COTTRELL
     DEVELOPMENT LEVEL                            FULL SCALE
     NEW/RETROFIT                                 NEW
     PARTICULATE DESIGN REMOVAL EFFICIENCY - %      99.40
     SO2 DESIGN REMOVAL EFFICIENCY - %              71.00
     INITIAL START-UP                              5/78

** ABSORBER
     NUMBER                                        6
     TYPE                                         PACKED SPRAY TOWER
     INITIAL START UP                              5/78
     SUPPLIER                                     RESEARCH COTTRELL
     NUMBER OF STAGES                                 3
     DIMENSIONS                                   28 DIA. X 200 TALL
     BOILER LOAD/ABSORBER - %                        12.5
     GAS FLOW - CU.M/S                              177.13      ( 375350 ACFM)
     GAS TEMPERATURE - C                            162.8       (  325 F)

** CENTRIFUGE
     OUTLET SOLIDS - %                               69.0

** FANS
     NUMBER                                        4
     TYPE                                         BOILER I.D.

** MIST ELIMINATOR
     NUMBER                                       12
     TYPE                                         CHEVRON
```

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                                  SECTION 3
                 DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS
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** REHEATER
     TYPE                                            BY PASS
     TEMPERATURE BOOST - C                             40.0        (   72 F)

** THICKENER
     NUMBER                                            1
     TYPE                                            GRAVITY
     DIAMETER - M                                      42.7        (140 FT)
     OUTLET SOLIDS - %                                 35.0

** WATER LOOP
     TYPE                                            CLOSED
     FRESH MAKEUP WATER ADDITION - LITERS/S            34.6        (  550 GPM)

** TREATMENT
     TYPE                                            FLYASH STABLIZATION
     SUPPLIER                                        NONPROPRIETARY
     PRODUCT CHARACTERISTICS                         CENTRIFUGE SOLIDS MIXED WITH FLY ASH

** DISPOSAL
     NATURE                                          FINAL
     TYPE                                            LANDFILL
     LOCATION                                        ON-SITE
     TRANSPORTATION                                  RAIL

-------------------------------------------PERFORMANCE DATA----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL  PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- -----------  ----- ----- ----- ------ ----- ------

 5/78  SYSTEM                                                               744

 6/78  SYSTEM                                                               720

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    6/78      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE      7/78      COMMENTS:
                         THE UNIT BEGAN OPERATIONS IN MAY 1978. THE COMPLIANCE TESTING IS SCHEDUL-
                         ED FOR AUGUST.
           AFFECTED MODULES: SYSTEM

 7/78  SYSTEM                                                               744

 8/78  SYSTEM                                                               744

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    8/78      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE      9/78      COMMENTS:
                         THE FGD SYSTEM WAS TESTED FOR COMPLIANCE WITH ALL SIX MODULES IN THE GAS
                         STREAM DURING THE FIRST PART OF AUGUST.  TEST RESULTS HAVE NOT YET BEEN
                         PUBLISHED.  NO MAJOR FGD-RELATED PROBLEMS WERE REPORTED.
           AFFECTED MODULES: SYSTEM

 9/78  SYSTEM                                                               720

10/78  SYSTEM                                                               744

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   10/78      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE     11/78      COMMENTS:
                         COMPLIANCE TEST RESULTS ARE BEING REVIEWED.
           AFFECTED MODULES: SYSTEM

11/78  SYSTEM                                                               720

12/78  SYSTEM                                                               744

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE   12/78      EQUIPMENT: BOILER-RELATED
           END DATE      1/79      PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                         COAL HANDLING WAS A SERIOUS PROBLEM DUE TO FREEZING OF THE COAL IN THE
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-----------------------------------------PERFORMANCE DATA------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
                        HOPPERS.  THIS PROBLEM EFFECTED ALL UNITS AT MARTIN LAKE FORCING THE GAS
                        AND OIL UNITS TO CARRY THE LOAD.
                AFFECTED MODULES: SYSTEM

            ** PROBLEMS/SOLUTIONS/COMMENTS
                START DATE  12/78      EQUIPMENT: FGD SYSTEM, GENERAL
                END DATE     1/79      COMMENTS:
                        NO PROBLEMS HAVE BEEN REPORTED.
                        PERIOD.
                AFFECTED MODULES: SYSTEM SYSTEM

            ** PROBLEMS/SOLUTIONS/COMMENTS
                START DATE  12/78      EQUIPMENT: FGD SYSTEM, GENERAL
                END DATE     1/79      COMMENTS:
                        THE FGD HAS REPORTEDLY RAN WELL DURING DECEMBER AND JANUARY.
                AFFECTED MODULES: SYSTEM

            ** PROBLEMS/SOLUTIONS/COMMENTS
                START DATE  12/78      EQUIPMENT: SLUDGE DISPOSAL
                END DATE     1/79      PROBLEM: NOT DEFINED/SPECIFIED
                        THE FGD SYSTEM WAS SHUT DOWN WHILE THE BOTTOM ASH POND WAS CLEANED OUT.
                        THE UTILITY HAS BEEN DUMPING SLUDGE INTO THE POND WHICH WAS DESIGNED FOR
                        BOTTOM ASH ONLY.  ALSO SLUDGE IS PRODUCED FASTER THAN IT IS REMOVED BY RAI
                        CAR.  THE UTILITY IS NOT GETTING RAIL CARS FAST ENOUGH.  THE ACTUAL
                        PROBLEM IS REPORTEDLY IN THE DEWATERING SYSTEM.
                AFFECTED MODULES: SYSTEM

            ** PROBLEMS/SOLUTIONS/COMMENTS
                START DATE  12/78      EQUIPMENT: MIST ELIMINATOR
                END DATE     1/79      PROBLEM: NOT DEFINED/SPECIFIED
                        SOME MIST ELIMINATOR PROBLEMS WERE ENCOUNTERED.
                AFFECTED MODULES: SYSTEM

 1/79  SYSTEM                                                              744
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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COMPANY NAME                                       TEXAS UTILITIES
PLANT NAME                                         MONTICELLO
UNIT NUMBER                                        3
CITY                                               MT. PLEASANT
STATE                                              TEXAS
REGULATORY CLASSIFICATION                          A
PARTICULATE EMISSION LIMITATION - NG/J             ******          (****** LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                     ******          (****** LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW                  1900.0
GROSS UNIT GENERATING CAPACITY - MW                  800.0
NET UNIT GENERATING CAPACITY W/FGD - MW              750.0
NET UNIT GENERATING CAPACITY WO/FGD - MW           *******
EQUIVALENT SCRUBBED CAPACITY - MW                    800.0

** BOILER DATA
     SUPPLIER                                      COMBUSTION ENGINEERING
     TYPE                                          PULVERIZED COAL
     SERVICE LOAD                                  BASE
     COMMERCIAL SERVICE DATE                        0/78
     MAXIMUM BOILER FLUE GAS FLOW - CU.M/S         ********        (******* ACFM)
     FLUE GAS TEMPERATURE - C                        168.3         ( 335 F)
     STACK HEIGHT - M                              ******          (**** FT)
     STACK TOP DIAMETER - M                        *******         (***** FT)

** FUEL DATA
     FUEL TYPE                                     COAL
     FUEL GRADE                                    LIGNITE
     AVERAGE HEAT CONTENT - KJ/KG                  *******         (****** BTU/LB)
     RANGE HEAT CONTENT - BTU/LB                                    6500-7500
     AVERAGE ASH CONTENT - %                          18.90
     RANGE ASH CONTENT - %                         ******
     AVERAGE MOISTURE CONTENT - %                  ********
     RANGE MOISTURE CONTENT - %                    ******
     AVERAGE SULFUR CONTENT - %                        1.50
     RANGE SULFUR CONTENT - %                      ******
     AVERAGE CHLORIDE CONTENT - %                        .04
     RANGE CHLORIDE CONTENT - %                    ******
     FUEL FIRING RATE - M T/H                      *******         (*** TPH)
     FUEL FIRING RATE - MW                         *****

** ESP
     NUMBER                                         2
     TYPE                                          COLD SIDE
     SUPPLIER                                      C-E WALTHER
     PARTICULATE DESIGN REMOVAL EFFICIENCY - %       99.5
     FLUE GAS TEMPERATURE - C                        168.3         (  335 F)

** FGD SYSTEM
     SALEABLE PRODUCT/THROWAWAY PRODUCT            THROWAWAY PRODUCT
     GENERAL PROCESS TYPE                          WET SCRUBBING
     PROCESS TYPE                                  LIMESTONE
     SYSTEM SUPPLIER                               CHEMICO
     DEVELOPMENT LEVEL                             FULL-SCALE
     NEW/RETROFIT                                  NEW
     PARTICULATE DESIGN REMOVAL EFFICIENCY - %       99.50
     SO2 DESIGN REMOVAL EFFICIENCY - %               74.00
     COMMERCIAL DATE                               10/78
     INITIAL START-UP                               5/79

** ABSORBER
     NUMBER                                         3
     TYPE                                          SPRAY TOWERS
     INITIAL START UP                               5/78
     SUPPLIER                                      CHEMICO
     NUMBER OF STAGES                                4
     BOILER LOAD/ABSORBER - %                        33.0
     GAS FLOW - CU.M/S                              428.01         ( 907000 ACFM)
     GAS TEMPERATURE - C                             60.6          (  141 F)
     LIQUID RECIRCULATION RATE - LITER/S           4000.           (63490 GPM)
     L/G RATIO - L/CU.M                               9.4          ( 70.0 GAL/1000ACF)
     PRESSURE DROP - KPA                              1.2          ( 5.0 IN-H2O)
     PARTICULATE INLET LOAD - G/CU.M                   .1          (  .050 GR/SCF)
     PARTICULATE OUTLET LOAD- G/CU.M                   .1          (  .050 GR/SCF)
     SO2 INLET CONCENTRATION - PPM                 1353
     SO2 OUTLET CONTRATION - PPM                    496
     SO2 DESIGN REMOVAL EFFICIENCY - %               74.0
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 ** FANS
     NUMBER                                              3
     TYPE                                              BOILER I.D.

 ** MIST ELIMINATOR
     NUMBER                                              3
     TYPE                                              CHEVRON
     CONFIGURATION                                     HORIZONTAL
     NUMBER OF STAGES                                      1

 ** PUMPS
     SERVICE                                           NUMBER
     -------                                           ------
     RECYCLE                                               3
     LIMESTONE SLURRY PUMP                             ****

 ** TANKS
     SERVICE                                           NUMBER
     -------                                           ------
     LIMESTONE SLURRY                                  ****
     RECYCLE                                           ****

 ** REHEATER
     TYPE                                              INDIRECT HOT AIR
     HEATING MEDIUM                                    STEAM

 ** WATER LOOP
     TYPE                                              CLOSED
     FRESH MAKEUP WATER ADDITION - LITERS/S               34.4         ( 546 GPM)

 ** TREATMENT
     TYPE                                              FLYASH STABILIZED

 ** DISPOSAL
     NATURE                                            FINAL
     TYPE                                              LANDFILL
     LOCATION                                          ON-SITE


------------------------------------------PERFORMANCE DATA-------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2 PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

 4/78  SYSTEM                                                              720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   4/78    EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     5/78    COMMENTS:
                         THE TEXAS AIR CONTROL BOARD REPORTED THAT THE TEXAS UTILITIES 750 MW
                         MONTICELLO UNIT 3 BEGAN FGD OPERATIONS DURING THE REPORT PERIOD.  AS OF
                         YET THE UNIT HAS NOT RUN AT FULL LOAD BUT IS EXPECTED TO BY THE END OF
                         AUGUST.
            AFFECTED MODULES: SYSTEM

 5/78  SYSTEM                                                              744

 6/78  SYSTEM                                                              720

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   6/78    EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     7/78    COMMENTS:
                         THE UNIT IS NOT AT FULL LOAD YET.  ONE OF THE THREE FGD MODULES IS FULLY
                         OPERATIONAL.  ANOTHER ONE IS PARTIALLY OPERATIONAL, WHILE THE THIRD IS NOT
                         OPERATING AT ALL AS YET.
            AFFECTED MODULES: SYSTEM

 7/78  SYSTEM                                                              744

 8/78  SYSTEM                                                              744

       ** PROBLEMS/SOLUTIONS/COMMENTS
            START DATE   8/78    EQUIPMENT: FGD SYSTEM, GENERAL
            END DATE     9/78    COMMENTS:
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------------------------------------------PERFORMANCE DATA-----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD    CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ----- ----- ------
                          THE COMPLIANCE TEST HAS NOT YET TAKEN PLACE.  THE FGD SYSTEM IS OPERATION-
                          AL.  INSTRUMENTATION INDICATES THAT THE UNIT IS IN COMPLIANCE.
             AFFECTED MODULES: SYSTEM

 9/78  SYSTEM                                                                720

10/78  SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/78      EQUIPMENT: INSTRUMENTATION
             END DATE    11/78      PROBLEM: NOT DEFINED/SPECIFIED
                          CONTINUOUS NOX,O2, AND SO2 MONITORS ARE A PROBLEM AREA.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  10/78      EQUIPMENT: SLUDGE DISPOSAL
             END DATE    11/78      COMMENTS:
                          THE SLUDGE IS CURRENTLY NOT FIXATED.  IT IS BEING PUMPED DIRECTLY TO THE
                          POND.
             AFFECTED MODULES: SYSTEM

11/78  SYSTEM                                                                720

12/78  SYSTEM                                                                744

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  12/78      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE    12/78      COMMENTS:
                          THE FGD SYSTEM IS FULLY OPERATIONAL.  A PRELIMINARY TEST WAS PERFORMED ON
                          DECEMBER 14.  RESULTS OF THE TEST ARE NOT YET AVAILABLE.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  12/78      EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE     1/79      COMMENTS:
                          THE FGD SYSTEM REPORTEDLY HAS BEEN PERFORMING WELL.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE  12/78      EQUIPMENT: ESP
             END DATE     1/79      PROBLEM: MATERIALS FAILURE,OTHER
                          THE ESP IS NOT OPERATING WELL.  COLLECTION EFFICIENCY IS NOT AS HIGH AS IT
                          SHOULD BE.  AMMONIA INJECTION HAS BEEN TRIED TO IMPROVE ITS EFFICIENCY.
                          REPORTEDLY THE PROBLEM IS THE RESULT OF STRUCTURAL DAMAGE.
             AFFECTED MODULES: SYSTEM

 1/79  SYSTEM                                                                744
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SECTION 3
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL FGD SYSTEMS

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COMPANY NAME                                     UTAH POWER & LIGHT
PLANT NAME                                       HUNTINGTON
UNIT NUMBER                                      1
CITY                                             PRICE
STATE                                            UTAH
REGULATORY CLASSIFICATION                        A
PARTICULATE EMISSION LIMITATION - NG/J           ******          (****** LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                   ******          (****** LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW                 810.0
GROSS UNIT GENERATING CAPACITY - MW                430.0
NET UNIT GENERATING CAPACITY W/FGD - MW            400.0
NET UNIT GENERATING CAPACITY WO/FGD - MW         *******
EQUIVALENT SCRUBBED CAPACITY - MW                  366.0

 ** BOILER DATA
     SUPPLIER                                    COMBUSTION ENGINEERING
     TYPE                                        PULVERIZED COAL, TANGENTIALLY FIRED
     SERVICE LOAD                                BASE
     COMMERCIAL SERVICE DATE                      0/78
     MAXIMUM BOILER FLUE GAS FLOW - CU.M/S         822.05        (1742000 ACFM)
     FLUE GAS TEMPERATURE - C                      130.0         ( 266 F)
     STACK HEIGHT - M                              183.          ( 600 FT)
     STACK TOP DIAMETER - M                      *******         (***** FT)

 ** FUEL DATA
     FUEL TYPE                                   COAL
     FUEL GRADE                                  ******
     AVERAGE HEAT CONTENT - KJ/KG                *******         (****** BTU/LB)
     RANGE HEAT CONTENT - BTU/LB                                  ******
     AVERAGE ASH CONTENT - %                        10.00
     RANGE ASH CONTENT - %                       ******
     AVERAGE MOISTURE CONTENT - %                ********
     RANGE MOISTURE CONTENT - %                  ******
     AVERAGE SULFUR CONTENT - %                       .50
     RANGE SULFUR CONTENT - %                    ******
     AVERAGE CHLORIDE CONTENT - %                ********
     RANGE CHLORIDE CONTENT - %                  ******
     FUEL FIRING RATE - M T/H                      151.5         (167 TPH)
     FUEL FIRING RATE - MW                         430

 ** ESP
     NUMBER                                        1
     TYPE                                        COLD SIDE
     SUPPLIER                                    BUELL/ENVIROTECH

 ** FGD SYSTEM
     SALEABLE PRODUCT/THROWAWAY PRODUCT          THROWAWAY PRODUCT
     GENERAL PROCESS TYPE                        WET SCRUBBING
     PROCESS TYPE                                LIME
     SYSTEM SUPPLIER                             CHEMICO
     A-E FIRM                                    STEARNS & ROGERS
     DEVELOPMENT LEVEL                           FULL-SCALE
     NEW/RETROFIT                                NEW
     PARTICULATE DESIGN REMOVAL EFFICIENCY - %      99.50
     SO2 DESIGN REMOVAL EFFICIENCY - %              80.00
     INITIAL START-UP                             5/78

 ** ABSORBER
     NUMBER                                       4
     TYPE                                        SPRAY TOWERS
     INITIAL START UP                             5/78
     SUPPLIER                                    CHEMICO
     SHELL MATERIAL                              CARBON STEEL
     SHELL LINER MATERIAL                        POLYESTER FLAKEGLASS
     GAS TEMPERATURE - C                           130.0         (  266 F)
     L/G RATIO - L/CU.M                              5.7         ( 43.0 GAL/1000ACF)

 ** FANS
     NUMBER                                       2
     TYPE                                        BOILER I.D.

 ** FANS
     NUMBER                                       2
     TYPE                                        FGD F.D.
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 ** VACUUM FILTER
     NUMBER                                      1
     OUTLET SOLIDS - %                           60.0

 ** MIST ELIMINATOR
     NUMBER                                      4
     CONSTRUCTION MATERIAL                       POLYPROPYLENE
     CONFIGURATION                               HORIZONTAL
     NUMBER OF PASSES                            4
     FREEBOARD DISTANCE - M                        3.66        (12.0 FT)

 ** PUMPS
     SERVICE                                     NUMBER
     -------                                     ------
     RECYCLE                                       4

 ** TANKS
     SERVICE                                     NUMBER
     -------                                     ------
     RECYCLE                                       4

 ** REHEATER
     TYPE                                        IN-LINE
     HEATING MEDIUM                              STEAM
     TEMPERATURE BOOST - C                         26.7        (   48 F)

 ** REHEATER
     TYPE                                        BYPASS
     TEMPERATURE BOOST - C                         26.7        (   48 F)

 ** THICKENER
     NUMBER                                      1
     TYPE                                        CYLINDRICAL WITH DORR OLIVER RAKE
     CONSTRUCTION MATERIAL                       CARBON STEEL WITH FLAKEGLASS LINING
     DIAMETER - M                                  18.3        ( 60 FT)
     OUTLET SOLIDS - %                             27.5

 ** WATER LOOP
     TYPE                                        CLOSED
     FRESH MAKEUP WATER ADDITION - LITERS/S        18.9        (  300 GPM)

 ** TREATMENT
     TYPE                                        NONPROPRIETARY FLYASH STABILIZED

 ** DISPOSAL
     NATURE                                      FINAL
     TYPE                                        LANDFILL
     LOCATION                                    ON SITE
     TRANSPORTATION                              TRUCK


-------------------------------------------PERFORMANCE DATA------------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION  % REMOVAL   PER  BOILER  FGD   CAP.
                                                                SO2  PART. HOURS HOURS  HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

 5/78   SYSTEM

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    5/78      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE      5/78      COMMENTS:
                         INITIAL OPERATIONS BEGAN ON MAY 10, 1978.
           AFFECTED MODULES: SYSTEM

 6/78   SYSTEM                                                                720   720

      ** PROBLEMS/SOLUTIONS/COMMENTS
           START DATE    6/78      EQUIPMENT: FGD SYSTEM, GENERAL
           END DATE      7/78      COMMENTS:
                         THE UTILITY REPORTED THAT 10-20% OF THE FLUE GAS WAS BYPASSED.
           AFFECTED MODULES: SYSTEM

 7/78   SYSTEM                                                                744   731
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-------------------------------------------PERFORMANCE DATA-----------------------------------------
PERIOD MODULE AVAILABILITY OPERABILITY RELIABILITY UTILIZATION % REMOVAL     PER BOILER   FGD   CAP.
                                                                 SO2 PART. HOURS  HOURS HOURS FACTOR
------ ------ ------------ ----------- ----------- ----------- ----- ----- ----- ------ ----- ------

  8/78 SYSTEM                                                                744    544

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    8/78    EQUIPMENT: BOILER-RELATED
             END DATE      9/78    COMMENTS:
                          AN EXPLOSION CAUSED A THREE WEEK BOILER OUTAGE.
             AFFECTED MODULES: SYSTEM

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE    8/78    EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE      9/78    COMMENTS:
                          THE UTILITY REPORTED THAT THERE WERE NO FORCED FGD OUTAGES.
             AFFECTED MODULES: SYSTEM

  9/78 SYSTEM                                                                720    496

 10/78 SYSTEM                  100.0                   100.0                 744    744  7440

 11/78 SYSTEM                   62.4                    62.4                 720    720  4490

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   11/78    EQUIPMENT: THICKENER
             END DATE     12/78    PROBLEM: NOT DEFINED/SPECIFIED
                          THE THICKENER HAD SOLIDS BUILDUP THE LAST OF NOVEMBER AND THE FIRST PART
                          OF DECEMBER FORCING SYSTEM SHUTDOWN TO ALLOW MANUAL REMOVAL OF THE SOLIDS.
             AFFECTED MODULES: SYSTEM

 12/78 SYSTEM                   34.0                    32.7                 744    715  2430

       ** PROBLEMS/SOLUTIONS/COMMENTS
             START DATE   12/78    EQUIPMENT: FGD SYSTEM, GENERAL
             END DATE      1/79    PROBLEM: WEATHER-RELATED COMPONENT FAILURE
                          FREEZE-UP PROBLEMS CAUSED OUTAGES OF A FEW WEEKS DURATION.
             AFFECTED MODULES: SYSTEM

  1/79  489                     76.2                    65.7
       SYSTEM                                                                744    642
```

SECTION 4
SUMMARY OF FGD SYSTEMS BY COMPANY

			STATUS							
	TOTAL		OPERATIONAL		CONSTRUCTION		CONTRACT AWARDED		PLANNED	
COMPANY NAME	NO.	MW	NO.	MW	NO.	MW	NO.	MW	NO.	MW
ALABAMA ELECTRIC COOP	2	358.	1	179.	1	179.	0	0.	0	0.
ALLEGHENY POWER SYSTEM	3	1338.	0	0.	2	1038.	0	0.	1	300.
ARIZONA ELECTRIC POWER COOP	2	360.	1	180.	1	180.	0	0.	0	0.
ARIZONA PUBLIC SERVICE	8	2684.	2	469.	4	705.	2	1510.	0	0.
ASSOCIATED ELECTRIC COOP	1	670.	0	0.	0	0.	1	670.	0	0.
BASIN ELECTRIC POWER COOP	5	2680.	0	0.	2	1200.	2	1040.	1	440.
BIG RIVERS ELECTRIC	2	484.	0	0.	2	484.	0	0.	0	0.
CENTRAL ILLINOIS LIGHT	2	832.	1	416.	0	0.	0	0.	1	416.
CENTRAL ILLINOIS PUBLIC SERV	1	617.	0	0.	1	617.	0	0.	0	0.
CENTRAL MAINE POWER	1	600.	0	0.	0	0.	0	0.	1	600.
CINCINNATI GAS & ELECTRIC	1	650.	0	0.	1	650.	0	0.	0	0.
COLORADO UTE ELECTRIC ASSN.	2	900.	0	0.	2	900.	0	0.	0	0.
COLUMBUS & SOUTHERN OHIO ELEC.	4	1572.	2	822.	0	0.	0	0.	2	750.
COMMONWEALTH EDISON	1	425.	0	0.	1	425.	0	0.	0	0.
COOPERATIVE POWER ASSOCIATION	2	654.	0	0.	2	654.	0	0.	0	0.
DELMARVA POWER & LIGHT	1	180.	0	0.	1	180.	0	0.	0	0.
DUQUESNE LIGHT	2	920.	2	920.	0	0.	0	0.	0	0.
EAST KENTUCKY POWER COOP	1	500.	0	0.	0	0.	1	500.	0	0.
GENERAL PUBLIC UTILITIES	2	1600.	0	0.	0	0.	0	0.	2	1600.
GULF POWER	1	23.	1	23.	0	0.	0	0.	0	0.
HOOSIER ENERGY	2	882.	0	0.	2	882.	0	0.	0	0.
HOUSTON LIGHTING & POWER CO.	1	512.	0	0.	0	0.	0	0.	1	512.
INDIANAPOLIS POWER & LIGHT	2	1062.	1	532.	1	530.	0	0.	0	0.
KANSAS CITY POWER & LIGHT	3	1094.	3	1094.	0	0.	0	0.	0	0.
KANSAS POWER & LIGHT	4	1575.	3	1085.	1	490.	0	0.	0	0.
KENTUCKY UTILITIES	1	64.	1	64.	0	0.	0	0.	0	0.
LAKELAND UTILITIES	1	364.	0	0.	0	0.	1	364.	0	0.
LOUISVILLE GAS & ELECTRIC	10	3508.	4	885.	3	1123.	1	350.	2	1150.
MIDDLE SOUTH UTILITIES	6	5340.	0	0.	0	0.	0	0.	6	5340.
MINNESOTA POWER & LIGHT	1	475.	0	0.	1	475.	0	0.	0	0.
MINNKOTA POWER COOPERATIVE	1	405.	1	405.	0	0.	0	0.	0	0.
MONTANA POWER	4	2120.	2	720.	0	0.	2	1400.	0	0.
NEVADA POWER	10	3125.	3	375.	0	0.	0	0.	7	2750.
NIAGARA MOHAWK POWER COOP	1	100.	0	0.	0	0.	1	100.	0	0.
NORTHERN INDIANA PUB SERVICE	3	705.	1	115.	0	0.	0	0.	2	590.
NORTHERN STATES POWER	3	2160.	2	1440.	0	0.	0	0.	1	720.
OTTER TAIL POWER	1	440.	0	0.	1	440.	0	0.	0	0.
PACIFIC GAS & ELECTRIC	2	1600.	0	0.	0	0.	0	0.	2	1600.
PACIFIC POWER & LIGHT	1	550.	0	0.	1	550.	0	0.	0	0.
PENNSYLVANIA POWER	3	2751.	2	1834.	1	917.	0	0.	0	0.
PHILADELPHIA ELECTRIC	4	844.	1	120.	0	0.	0	0.	3	724.
POTOMAC ELECTRIC POWER	1	800.	0	0.	0	0.	0	0.	1	800.
POWER AUTHORITY OF NEW YORK	1	700.	0	0.	0	0.	0	0.	1	700.
PUBLIC SERVICE OF INDIANA	1	650.	0	0.	0	0.	0	0.	1	650.
PUBLIC SERVICE OF NEW MEXICO	4	1779.	2	711.	0	0.	2	1068.	0	0.
SALT RIVER PROJECT	3	840.	0	0.	2	560.	0	0.	1	280.
SAN MIGUEL ELECTRIC COOP	1	400.	0	0.	1	400.	0	0.	0	0.
SEMINOLE ELECTRIC	1	620.	0	0.	0	0.	0	0.	1	620.
SIKESTON BOARD OF MUNIC. UTIL.	1	235.	0	0.	1	235.	0	0.	0	0.
SOUTH CAROLINA PUBLIC SERVICE	2	440.	1	140.	0	0.	1	300.	0	0.
SOUTHERN CALIFORNIA EDISON	1	175.	0	0.	0	0.	1	175.	0	0.
SOUTHERN ILLINOIS POWER COOP	2	484.	0	0.	1	184.	0	0.	1	300.
SOUTHERN INDIANA GAS & ELEC	1	265.	0	0.	1	265.	0	0.	0	0.
SOUTHERN MISSISSIPPI ELECTRIC	2	248.	1	124.	1	124.	0	0.	0	0.
SOUTHWESTERN ELECTRIC POWER	1	720.	0	0.	0	0.	1	720.	0	0.
SPRINGFIELD CITY UTILITIES	1	194.	1	194.	0	0.	0	0.	0	0.
SPRINGFIELD WATER, LIGHT & PWR	1	205.	0	0.	1	205.	0	0.	0	0.
ST. JOE ZINC	1	60.	0	0.	1	60.	0	0.	0	0.
TAMPA ELECTRIC	1	450.	0	0.	0	0.	0	0.	1	450.
TENNESSEE VALLEY AUTHORITY	8	3753.	3	570.	1	575.	2	1408.	2	1200.
TEXAS MUNICIPAL POWER AGENCY	1	400.	0	0.	0	0.	1	400.	0	0.
TEXAS POWER & LIGHT	3	1882.	0	0.	1	382.	0	0.	2	1500.
TEXAS UTILITIES	8	1585.	3	1990.	1	595.	1	750.	3	2250.
UTAH POWER & LIGHT	3	1086.	1	366.	2	720.	0	0.	0	0.
WISCONSIN POWER & LIGHT	1	316.	0	0.	0	0.	1	316.	0	0.
TOTALS	158	70010.	46	15773.	45	16924.	21	11071.	46	26242.

NOTE - PLANNED STATUS INCLUDES LETTER OF INTENT SIGNED, REQUESTING/EVALUTING BIDS, AND CONSIDERING ONLY FGD SYSTEMS

SECTION 5
SUMMARY OF FGD SYSTEMS BY SYSTEM SUPPLIER

			STATUS					
	TOTAL		OPERATIONAL		CONSTRUCTION		CONTRACT AWARDED	
SYSTEM SUPPLIER/PROCESS	NO.	MW	NO.	MW	NO.	MW	NO.	MW
ADL/COMBUSTION EQUIP ASSOCIATE								
DUAL ALKALI	1	278.	0	0.	1	278.	0	0.
LIME	3	1220.	2	720.	0	0.	1	500.
LIME/ALKALINE FLYASH	3	1805.	1	405.	0	0.	2	1400.
SODIUM CARBONATE	3	375.	3	375.	0	0.	0	0.
TOTAL -	10	3678.	6	1500.	1	278.	3	1900.
AIR CORRECTION DIVISION, UOP								
LIME	2	822.	2	822.	0	0.	0	0.
LIMESTONE	4	1871.	2	726.	1	425.	1	720.
LIME/LIMESTONE	1	10.	1	10.	0	0.	0	0.
SODIUM CARBONATE	1	550.	0	0.	1	550.	0	0.
TOTAL -	8	3253.	5	1558.	2	975.	1	720.
AMERICAN AIR FILTER								
LIME	6	1658.	3	679.	3	979.	0	0.
TOTAL -	6	1658.	3	679.	3	979.	0	0.
BABCOCK & WILCOX								
LIME	3	1688.	0	0.	3	1688.	0	0.
LIME (DRY COLLECTION)	1	600.	0	0.	0	0.	1	600.
LIMESTONE	7	2497.	2	1014.	3	819.	2	664.
TOTAL -	11	4785.	2	1014.	6	2507.	3	1264.
BUELL/ENVIROTECH								
DUAL ALKALI	1	617.	0	0.	1	617.	0	0.
TOTAL -	1	617.	0	0.	1	617.	0	0.
BUREAU OF MINES								
CITRATE	1	60.	0	0.	1	60.	0	0.
TOTAL -	1	60.	0	0.	1	60.	0	0.
CHEMICO								
LIME	7	3840.	5	3120.	2	720.	0	0.
LIMESTONE	1	800.	1	800.	0	0.	0	0.
LIME/ALKALINE FLYASH	4	895.	0	0.	3	579.	1	316.
LIME/LIMESTONE	1	10.	1	10.	0	0.	0	0.
TOTAL -	13	5545.	7	3930.	5	1299.	1	316.
CHIYODA INTERNATIONAL								
LIMESTONE (CHIYODA 121)	1	23.	1	23.	0	0.	0	0.
TOTAL -	1	23.	1	23.	0	0.	0	0.
COMBUSTION ENGINEERING								
LIME	6	1144.	4	490.	2	654.	0	0.
LIMESTONE	7	2932.	3	1085.	3	1447.	1	400.
LIMESTONE/ALKALINE FLYASH	2	1440.	2	1440.	0	0.	0	0.
LIME/LIMESTONE	2	700.	0	0.	1	350.	1	350.
TOTAL -	17	6216.	9	3015.	6	2451.	2	750.
DAVY POWERGAS								
WELLMAN LORD	6	2074.	3	826.	1	180.	2	1068.
TOTAL -	6	2074.	3	826.	1	180.	2	1068.
FMC CORPORATION								
DUAL ALKALI	1	265.	0	0.	1	265.	0	0.
TOTAL -	1	265.	0	0.	1	265.	0	0.
JOY MFG. CO, WESTERN PRECIPITA								
LIME (DRY COLLECTION)	1	440.	0	0.	0	0.	1	440.
TOTAL -	1	440.	0	0.	0	0.	1	440.

SECTION 5
SUMMARY OF FGD SYSTEMS BY SYSTEM SUPPLIER

	TOTAL		STATUS					
			OPERATIONAL		CONSTRUCTION		CONTRACT AWARDED	
SYSTEM SUPPLIER/PROCESS	NO.	MW	NO.	MW	NO.	MW	NO.	MW
MITSUBISHI INTERNATIONAL								
LIMESTONE	2	882.	0	0.	2	882.	0	0.
TOTAL -	2	882.	0	0.	2	882.	0	0.
PEABODY PROCESS SYSTEMS								
LIMESTONE	4	1258.	1	179.	3	1079.	0	0.
LIME/ALKALINE FLYASH	1	475.	0	0.	1	475.	0	0.
TOTAL -	5	1733.	1	179.	4	1554.	0	0.
PULLMAN KELLOGG								
LIME	1	917.	0	0.	1	917.	0	0.
LIMESTONE	3	1230.	0	0.	2	560.	1	670.
TOTAL -	4	2147.	0	0.	3	1477.	1	670.
RESEARCH COTTRELL								
LIMESTONE	13	5425.	5	1839.	7	2836.	1	750.
TOTAL -	13	5425.	5	1839.	7	2836.	1	750.
RILEY STOKER/ENVIRONEERING								
LIMESTONE	3	664.	2	540.	1	124.	0	0.
TOTAL -	3	664.	2	540.	1	124.	0	0.
ROCKWELL INTERNATIONAL								
AQUEOUS CARBONATE	1	100.	0	0.	0	0.	1	100.
TOTAL -	1	100.	0	0.	0	0.	1	100.
SO. CALIFRONIA EDISON/STEARNS								
LIME	1	175.	0	0.	0	0.	1	175.
TOTAL -	1	175.	0	0.	0	0.	1	175.
TENNESSEE VALLEY AUTHORITY								
LIMESTONE	1	550.	1	550.	0	0.	0	0.
TOTAL -	1	550.	1	550.	0	0.	0	0.
UNITED ENGINEERS								
LIME	2	1510.	0	0.	0	0.	2	1510.
MAGNESIUM OXIDE	1	120.	1	120.	0	0.	0	0.
TOTAL -	3	1630.	1	120.	0	0.	2	1510.
VENDOR NOT SELECTED								
LIMESTONE	2	1408.	0	0.	0	0.	2	1408.
TOTAL -	2	1408.	0	0.	0	0.	2	1408.
WHEELABRATOR-FRYE/R.I.								
AQUEOUS CARBONATE (DRY COLLECT	1	440.	0	0.	1	440.	0	0.
TOTAL -	1	440.	0	0.	1	440.	0	0.
TOTAL -	112	43768.	46	15773.	45	16924.	21	11071.

SECTION 6
SUMMARY OF FGD SYSTEMS BY PROCESS

	TOTAL		STATUS OPERATIONAL		CONSTRUCTION		CONTRACT AWARDED		PLANNED	
PROCESS	NO.	MW	NO.	MW	NO.	MW	NO.	MW	NO.	MW
AQUEOUS CARBONATE	1	100.	0	0.	0	0.	1	100.	0	0.
CITRATE	1	60.	0	0.	1	60.	0	0.	0	0.
LIMESTONE/CHIYODA 121	1	23.	1	23.	0	0.	0	0.	0	0.
MAGNESIUM OXIDE	5	1444.	1	120.	0	0.	0	0.	4	1324.
WELLMAN LORD	6	2074.	3	826.	1	180.	2	1068.	0	0.
SUBTOTAL - SALEABLE PRODUCT	14	3701.	5	969.	2	240.	3	1168.	4	1324.
AQUEOUS CARBONATE/SPRAY DRYING	1	440.	0	0.	1	440.	0	0.	0	0.
DUAL ALKALI	3	1170.	0	0.	3	1170.	0	0.	0	0.
LIME	31	12941.	16	5798.	11	4958.	4	2185.	0	0.
LIMESTONE	56	25334.	17	6748.	22	8206.	8	4592.	9	5788.
LIMESTONE/ALKALINE FLYASH	2	1480.	2	1480.	0	0.	0	0.	0	0.
LIME/ALKALINE FLYASH	8	3175.	1	405.	4	1054.	3	1716.	0	0.
LIME/LIMESTONE	5	1328.	2	20.	1	358.	1	350.	1	600.
LIME/SPRAY DRYING	2	1040.	0	0.	0	0.	2	1040.	0	0.
PROCESS NOT SELECTED	32	18670.	0	0.	0	0.	0	0.	32	18670.
SODIUM CARBONATE	4	925.	3	375.	1	550.	0	0.	0	0.
SUBTOTAL - THROWAWAY PRODUCT	144	66503.	41	14826.	43	16736.	18	9883.	42	25058.
TOTALS	158	70204.	46	15795.	45	16976.	21	11051.	46	26382.
SALEABLE % OF TOTAL MW		5		6		1		11		5

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SECTION 7

SUMMARY OF OPERATIONAL FGD SYSTEMS BY PROCESS AND UNIT

PROCESS/ UNIT NAME	UNIT NO.	CAPACITY MW	INITIAL STARTUP	COMMERCIAL STARTUP
LIME				
PRUCE MANSFIELD	1	917.	12/75	6/76
BRUCE MANSFIELD	2	917.	7/77	10/77
CANE RUN	4	190.	8/76	9/77
CANE RUN	5	200.	12/77	6/78
COLSTRIP	1	360.	9/75	11/75
COLSTRIP	2	360.	5/76	10/76
CONESVILLE	5	411.	1/77	2/77
CONESVILLE	6	411.	6/78	6/78
ELRAMA	1-4	510.	10/75	10/75
GREEN RIVER	1-3	64.	9/75	6/76
HAWTHORN	3	110.	11/72	0/ 0
HAWTHORN	4	110.	8/72	0/ 0
HUNTINGTON	1	366.	5/78	0/ 0
MILL CREEK	3	425.	8/78	0/ 0
PADDY'S RUN	6	70.	4/73	0/ 0
PHILLIPS	1-6	410.	7/73	0/ 0

		5831.		
LIMESTONE				
APACHE	2	180.	8/78	11/78
CHOLLA	1	119.	10/73	12/73
CHOLLA	2	350.	4/78	0/ 0
DUCK CREEK	1	416.	7/76	8/78
JEFFREY	1	540.	8/78	8/78
LA CYGNE	1	874.	2/73	6/73
LAWRENCE	4	125.	1/76	0/ 0
LAWRENCE	5	420.	11/71	0/ 0
MARTIN LAKE	1	595.	4/77	8/77
MARTIN LAKE	2	595.	5/78	0/ 0
MONTICELLO	3	800.	5/78	10/78
PETERSBURG	3	532.	12/77	12/77
R.D. MORROW	1	124.	8/78	0/ 0
SOUTHWEST	1	194.	4/77	0/ 0
TOMBIGBEE	2	179.	9/78	0/ 0
WIDOWS CREEK	8	550.	5/77	1/78
WINYAH	2	140.	7/77	0/ 0

		6733.		
LIMESTONE (CHIYODA 121)				
SCHOLZ	1,2	23.	8/78	0/ 0

		23.		
LIMESTONE/ALKALINE FLYASH				
SHERBURNE	1	720.	3/76	3/76
SHERBURNE	2	720.	4/77	4/77

		1440.		
LIME/ALKALINE FLYASH				
MILTON R. YOUNG	2	405.	9/77	6/78

		405.		
LIME/LIMESTONE				
SHAWNEE	10A	10.	4/72	0/ 0
SHAWNEE	10B	10.	4/72	0/ 0

		20.		
MAGNESIUM OXIDE				
EDDYSTONE	1A	120.	9/75	9/75

		120.		

SECTION 7
SUMMARY OF OPERATIONAL FGD SYSTEMS BY PROCESS AND UNIT

PROCESS/ UNIT NAME	UNIT NO.	CAPACITY MW	INITIAL STARTUP	COMMERCIAL STARTUP
SODIUM CARBONATE				
REID GARDNER	1	125.	4/74	0/ 0
REID GARDNER	2	125.	4/74	0/ 0
REID GARDNER	3	125.	6/76	7/76
		375.		
WELLMAN LORD				
DEAN H. MITCHELL	11	115.	7/76	6/77
SAN JUAN	1	361.	4/78	0/ 0
SAN JUAN	2	350.	8/78	0/ 0
		826.		
TOTAL		15773.		

SECTION 8

SUMMARY OF END-PRODUCT DISPOSAL PRACTICES FOR OPERATIONAL FGD SYSTEMS

PROCESS/ UNIT NAME	UNIT NO	THROWAWAY STABILIZED	THROWAWAY UNSTABILIZED	BYPRODUCT TYPE	BYPRODUCT DISPOSITION
LIME					
BRUCE MANSFIELD	1	LANDFILL			
BRUCE MANSFIELD	2	LANDFILL			
CANE RUN	4		LINED POND		
CANE RUN	5	LINED POND			
COLSTRIP	1				
COLSTRIP	2		POND		
CONESVILLE	5	LANDFILL			
CONESVILLE	6	DIKED LANDFIL			
ELRAMA	1-4	LANDFILL			
GREEN RIVER	1-3		LINED POND		
HAWTHORN	3	UNLINED POND			
HAWTHORN	4	UNLINED POND			
HUNTINGTON	1	LANDFILL			
MILL CREEK	3	SLUDGE POND			
PADDY'S RUN	6	UNLINED POND			
PHILLIPS	1-6	LANDFILL			
LIMESTONE					
APACHE	2		SLUDGE POND		
CHOLLA	1		UNLINED POND		
CHOLLA	2		SLUDGE POND		
DUCK CREEK	1		LINED POND		
JEFFREY	1	UNLINED POND			
LA CYGNE	1		UNLINED POND		
LAWRENCE	4	UNLINED POND			
LAWRENCE	5	UNLINED POND			
MARTIN LAKE	1	LANDFILL			
MARTIN LAKE	2	LANDFILL			
MONTICELLO	3	LANDFILL			
PETERSBURG	3	UNLINED POND			
R.D. MORROW	1	LANDFILL			
SOUTHWEST	1	LANDFILL			
TOMBIGBEE	2	LINED POND			
WIDOWS CREEK	8		POND		
WINYAH	2		UNLINED POND		
LIMESTONE (CHIYODA 121)					
SCHOLZ	1,2			GYPSUM	STACKED IN POND
LIMESTONE/ALKALINE FLYASH					
SHERBURNE	1	LINED POND			
SHERBURNE	2	LINED POND			
LIME/ALKALINE FLYASH					
MILTON R. YOUNG	2		MINEFILL		
LIME/LIMESTONE					
SHAWNEE	10A				
SHAWNEE	10B				
MAGNESIUM OXIDE					
EDDYSTONE	1A			SULFURIC ACID	
SODIUM CARBONATE					
REID GARDNER	1		EVAP POND		
REID GARDNER	2		EVAP POND		
REID GARDNER	3		EVAP POND		

SECTION 8

SUMMARY OF END-PRODUCT DISPOSAL PRACTICES FOR OPERATIONAL FGD SYSTEMS

PROCESS/ UNIT NAME	UNIT NO	THROWAWAY STABILIZED	THROWAWAY UNSTABILIZED	BYPRODUCT TYPE	BYPRODUCT DISPOSITION
WELLMAN LORD					
DEAN H. MITCHELL	11			ELEMENTAL SULFUR	
SAN JUAN	1		ASH POND	ELEMENTAL SULFUR	MARKETED
SAN JUAN	2		ASH POND	ELEMENTAL SULFUR	MARKETED

SECTION 9
SUMMARY OF FGD SYSTEMS IN OPERATION

COMPANY NAME/ UNIT NAME	UNIT NO.	NEW OR RETROFIT	CAPACITY MW	PROCESS/ SYSTEM SUPPLIER	START-UP DATE
ALABAMA ELECTRIC COOP TOMBIGBEE	2	NEW	179.0	LIMESTONE PEABODY PROCESS SYSTEMS	9/78
ARIZONA ELECTRIC POWER COOP APACHE	2	NEW	180.0	LIMESTONE RESEARCH COTTRELL	8/78
ARIZONA PUBLIC SERVICE CHOLLA	1	RETROFIT	119.0	LIMESTONE RESEARCH COTTRELL	10/73
ARIZONA PUBLIC SERVICE CHOLLA	2	NEW	350.0	LIMESTONE RESEARCH COTTRELL	4/78
CENTRAL ILLINOIS LIGHT DUCK CREEK	1	NEW	416.0	LIMESTONE RILEY STOKER/ENVIRONEERING	7/76
COLUMBUS & SOUTHERN OHIO ELEC. CONESVILLE	5	NEW	411.0	LIME AIR CORRECTION DIVISION, UOP	1/77
COLUMBUS & SOUTHERN OHIO ELEC. CONESVILLE	6	NEW	411.0	LIME AIR CORRECTION DIVISION, UOP	6/78
DUQUESNE LIGHT ELRAMA	1-4	RETROFIT	510.0	LIME CHEMICO	10/75
DUQUESNE LIGHT PHILLIPS	1-6	RETROFIT	410.0	LIME CHEMICO	7/73
GULF POWER SCHOLZ	1,2	RETROFIT	23.0	LIMESTONE (CHIYODA 121) CHIYODA INTERNATIONAL	8/78
INDIANAPOLIS POWER & LIGHT PETERSBURG	3	NEW	532.0	LIMESTONE AIR CORRECTION DIVISION, UOP	12/77
KANSAS CITY POWER & LIGHT HAWTHORN	3	RETROFIT	110.0	LIME COMBUSTION ENGINEERING	11/72
KANSAS CITY POWER & LIGHT HAWTHORN	4	RETROFIT	110.0	LIME COMBUSTION ENGINEERING	8/72
KANSAS CITY POWER & LIGHT LA CYGNE	1	NEW	874.0	LIMESTONE BABCOCK & WILCOX	2/73
KANSAS POWER & LIGHT JEFFREY	1	NEW	540.0	LIMESTONE COMBUSTION ENGINEERING	8/78
KANSAS POWER & LIGHT LAWRENCE	4	RETROFIT	125.0	LIMESTONE COMBUSTION ENGINEERING	1/76
KANSAS POWER & LIGHT LAWRENCE	5	RETROFIT	420.0	LIMESTONE COMBUSTION ENGINEERING	11/71
KENTUCKY UTILITIES GREEN RIVER	1-3	RETROFIT	64.0	LIME AMERICAN AIR FILTER	9/75
LOUISVILLE GAS & ELECTRIC CANE RUN	4	RETROFIT	190.0	LIME AMERICAN AIR FILTER	8/76
LOUISVILLE GAS & ELECTRIC CANE RUN	5	RETROFIT	200.0	LIME COMBUSTION ENGINEERING	12/77
LOUISVILLE GAS & ELECTRIC MILL CREEK	3	NEW	425.0	LIME AMERICAN AIR FILTER	8/78
LOUISVILLE GAS & ELECTRIC PADDY'S RUN	6	RETROFIT	70.0	LIME COMBUSTION ENGINEERING	4/73
MINNKOTA POWER COOPERATIVE MILTON R. YOUNG	2	NEW	405.0	LIME/ALKALINE FLYASH ADL/COMBUSTION EQUIP ASSOCIATE	9/77
MONTANA POWER COLSTRIP	1	NEW	360.0	LIME ADL/COMBUSTION EQUIP ASSOCIATE	9/75

SECTION 9
SUMMARY OF FGD SYSTEMS IN OPERATION

COMPANY NAME/ UNIT NAME	UNIT NO.	NEW OR RETROFIT	CAPACITY MW	PROCESS/ SYSTEM SUPPLIER	START-UP DATE
MONTANA POWER COLSTRIP	2	NEW	360.0	LIME ADL/COMBUSTION EQUIP ASSOCIATE	5/76
NEVADA POWER REID GARDNER	1	RETROFIT	125.0	SODIUM CARBONATE ADL/COMBUSTION EQUIP ASSOCIATE	4/74
NEVADA POWER REID GARDNER	2	RETROFIT	125.0	SODIUM CARBONATE ADL/COMBUSTION EQUIP ASSOCIATE	4/74
NEVADA POWER REID GARDNER	3	NEW	125.0	SODIUM CARBONATE ADL/COMBUSTION EQUIP ASSOCIATE	6/76
NORTHERN INDIANA PUB SERVICE DEAN H. MITCHELL	11	RETROFIT	115.0	WELLMAN LORD DAVY POWERGAS	7/76
NORTHERN STATES POWER SHERBURNE	1	NEW	720.0	LIMESTONE/ALKALINE FLYASH COMBUSTION ENGINEERING	3/76
NORTHERN STATES POWER SHERBURNE	2	NEW	720.0	LIMESTONE/ALKALINE FLYASH COMBUSTION ENGINEERING	4/77
PENNSYLVANIA POWER BRUCE MANSFIELD	1	NEW	917.0	LIME CHEMICO	12/75
PENNSYLVANIA POWER BRUCE MANSFIELD	2	NEW	917.0	LIME CHEMICO	7/77
PHILADELPHIA ELECTRIC EDDYSTONE	1A	RETROFIT	120.0	MAGNESIUM OXIDE UNITED ENGINEERS	9/75
PUBLIC SERVICE OF NEW MEXICO SAN JUAN	1	RETROFIT	361.0	WELLMAN LORD DAVY POWERGAS	4/78
PUBLIC SERVICE OF NEW MEXICO SAN JUAN	2	RETROFIT	350.0	WELLMAN LORD DAVY POWERGAS	8/78
SOUTH CAROLINA PUBLIC SERVICE WINYAH	2	NEW	140.0	LIMESTONE BABCOCK & WILCOX	7/77
SOUTHERN MISSISSIPPI ELECTRIC R.D. MORROW	1	NEW	124.0	LIMESTONE RILEY STOKER/ENVIRONEERING	8/78
SPRINGFIELD CITY UTILITIES SOUTHWEST	1	NEW	194.0	LIMESTONE AIR CORRECTION DIVISION, UOP	4/77
TENNESSEE VALLEY AUTHORITY SHAWNEE	10A	RETROFIT	10.0	LIME/LIMESTONE AIR CORRECTION DIVISION, UOP	4/72
TENNESSEE VALLEY AUTHORITY SHAWNEE	10B	RETROFIT	10.0	LIME/LIMESTONE CHEMICO	4/72
TENNESSEE VALLEY AUTHORITY WIDOWS CREEK	8	RETROFIT	550.0	LIMESTONE TENNESSEE VALLEY AUTHORITY	5/77
TEXAS UTILITIES MARTIN LAKE	1	NEW	595.0	LIMESTONE RESEARCH COTTRELL	4/77
TEXAS UTILITIES MARTIN LAKE	2	NEW	595.0	LIMESTONE RESEARCH COTTRELL	5/78
TEXAS UTILITIES MONTICELLO	3	NEW	800.0	LIMESTONE CHEMICO	5/78
UTAH POWER & LIGHT HUNTINGTON	1	NEW	366.0	LIME CHEMICO	5/78

SECTION 10
SUMMARY OF FGD SYSTEMS UNDER CONSTRUCTION

COMPANY NAME/ UNIT NAME	UNIT NO.	NEW OR RETROFIT	CAPACITY MW	PROCESS/ SYSTEM SUPPLIER	START-UP DATE
ALABAMA ELECTRIC COOP TOMBIGBEE	3	NEW	179.0	LIMESTONE PEABODY PROCESS SYSTEMS	6/79
ALLEGHENY POWER SYSTEM PLEASANTS	1	NEW	519.0	LIME BABCOCK & WILCOX	3/79
ALLEGHENY POWER SYSTEM PLEASANTS	2	NEW	519.0	LIME BABCOCK & WILCOX	3/80
ARIZONA ELECTRIC POWER COOP APACHE	3	NEW	180.0	LIMESTONE RESEARCH COTTRELL	4/79
ARIZONA PUBLIC SERVICE CHOLLA	4	NEW	126.0	LIMESTONE RESEARCH COTTRELL	6/80
ARIZONA PUBLIC SERVICE FOUR CORNERS	1	RETROFIT	175.0	LIME/ALKALINE FLYASH CHEMICO	0/79
ARIZONA PUBLIC SERVICE FOUR CORNERS	2	RETROFIT	175.0	LIME/ALKALINE FLYASH CHEMICO	0/79
ARIZONA PUBLIC SERVICE FOUR CORNERS	3	RETROFIT	229.0	LIME/ALKALINE FLYASH CHEMICO	0/79
BASIN ELECTRIC POWER COOP LARAMIE RIVER	1	NEW	600.0	LIMESTONE RESEARCH COTTRELL	4/80
BASIN ELECTRIC POWER COOP LARAMIE RIVER	2	NEW	600.0	LIMESTONE RESEARCH COTTRELL	10/80
BIG RIVERS ELECTRIC GREEN	1	NEW	242.0	LIME AMERICAN AIR FILTER	12/79
BIG RIVERS ELECTRIC GREEN	2	NEW	242.0	LIME AMERICAN AIR FILTER	12/80
CENTRAL ILLINOIS PUBLIC SERV NEWTON	1	NEW	617.0	DUAL ALKALI BUELL/ENVIROTECH	11/79
CINCINNATI GAS & ELECTRIC EAST BEND	2	NEW	650.0	LIME BABCOCK & WILCOX	10/81
COLORADO UTE ELECTRIC ASSN. CRAIG	1	NEW	450.0	LIMESTONE PEABODY PROCESS SYSTEMS	3/79
COLORADO UTE ELECTRIC ASSN. CRAIG	2	NEW	450.0	LIMESTONE PEABODY PROCESS SYSTEMS	3/79
COMMONWEALTH EDISON POWERTON	51	RETROFIT	425.0	LIMESTONE AIR CORRECTION DIVISION, UOP	7/79
COOPERATIVE POWER ASSOCIATION COAL CREEK	1	NEW	327.0	LIME COMBUSTION ENGINEERING	5/79
COOPERATIVE POWER ASSOCIATION COAL CREEK	2	NEW	327.0	LIME COMBUSTION ENGINEERING	10/80
DELMARVA POWER & LIGHT DELAWARE CITY	1-3	RETROFIT	180.0	WELLMAN LORD DAVY POWERGAS	4/80
HOOSIER ENERGY MEROM	1	NEW	441.0	LIMESTONE MITSUBISHI INTERNATIONAL	4/81
HOOSIER ENERGY MEROM	2	NEW	441.0	LIMESTONE MITSUBISHI INTERNATIONAL	1/82
INDIANAPOLIS POWER & LIGHT PETERSBURG	4	NEW	530.0	LIMESTONE RESEARCH COTTRELL	10/83
KANSAS POWER & LIGHT JEFFREY	2	NEW	490.0	LIMESTONE COMBUSTION ENGINEERING	6/80

SECTION 10
SUMMARY OF FGD SYSTEMS UNDER CONSTRUCTION

COMPANY NAME/ UNIT NAME	UNIT NO.	NEW OR RETROFIT	CAPACITY MW	PROCESS/ SYSTEM SUPPLIER	START-UP DATE
LOUISVILLE GAS & ELECTRIC CANE RUN	6	RETROFIT	278.0	DUAL ALKALI ADL/COMBUSTION EQUIP ASSOCIATE	3/79
LOUISVILLE GAS & ELECTRIC MILL CREEK	1	RETROFIT	350.0	LIME/LIMESTONE COMBUSTION ENGINEERING	4/81
LOUISVILLE GAS & ELECTRIC MILL CREEK	4	NEW	495.0	LIME AMERICAN AIR FILTER	7/81
MINNESOTA POWER & LIGHT CLAY BOSWELL	4	NEW	475.0	LIME/ALKALINE FLYASH PEABODY PROCESS SYSTEMS	5/80
OTTER TAIL POWER COYOTE	1	NEW	440.0	AQUEOUS CARBONATE (DRY COLLECT WHEELABRATOR-FRYE/R.I.	5/81
PACIFIC POWER & LIGHT JIM BRIDGER	4	NEW	550.0	SODIUM CARBONATE AIR CORRECTION DIVISION, UOP	9/79
PENNSYLVANIA POWER BRUCE MANSFIELD	3	NEW	917.0	LIME PULLMAN KELLOGG	4/80
SALT RIVER PROJECT CORONADO	1	NEW	280.0	LIMESTONE PULLMAN KELLOGG	8/79
SALT RIVER PROJECT CORONADO	2	NEW	280.0	LIMESTONE PULLMAN KELLOGG	1/80
SAN MIGUEL ELECTRIC COOP SAN MIGUEL	1	NEW	400.0	LIMESTONE BABCOCK & WILCOX	8/80
SIKESTON BOARD OF MUNIC. UTIL. SIKESTON	1	NEW	235.0	LIMESTONE BABCOCK & WILCOX	11/80
SOUTHERN ILLINOIS POWER COOP MARION	4	NEW	184.0	LIMESTONE BABCOCK & WILCOX	5/79
SOUTHERN INDIANA GAS & ELEC A.B. BROWN	1	NEW	265.0	DUAL ALKALI FMC CORPORATION	3/79
SOUTHERN MISSISSIPPI ELECTRIC R.D. MORROW	2	NEW	124.0	LIMESTONE RILEY STOKER/ENVIRONEERING	5/79
SPRINGFIELD WATER, LIGHT & PWR DALLMAN	3	NEW	205.0	LIMESTONE RESEARCH COTTRELL	8/80
ST. JOE ZINC G.F. WEATON	1	RETROFIT	60.0	CITRATE BUREAU OF MINES	4/79
TENNESSEE VALLEY AUTHORITY WIDOWS CREEK	7	RETROFIT	575.0	LIMESTONE COMBUSTION ENGINEERING	10/80
TEXAS POWER & LIGHT SANDOW	4	NEW	382.0	LIMESTONE COMBUSTION ENGINEERING	7/80
TEXAS UTILITIES MARTIN LAKE	3	NEW	595.0	LIMESTONE RESEARCH COTTRELL	2/79
UTAH POWER & LIGHT EMERY	1	NEW	360.0	LIME CHEMICO	4/79
UTAH POWER & LIGHT EMERY	2	NEW	360.0	LIME CHEMICO	6/80

SECTION 11
SUMMARY OF CONTRACT AWARDED FGD SYSTEMS

COMPANY NAME/ UNIT NAME	UNIT NO.	NEW OR RETROFIT	CAPACITY MW	PROCESS/ SYSTEM SUPPLIER	START-UP DATE
ARIZONA PUBLIC SERVICE FOUR CORNERS	4	RETROFIT	755.0	LIME UNITED ENGINEERS	0/82
ARIZONA PUBLIC SERVICE FOUR CORNERS	5	RETROFIT	755.0	LIME UNITED ENGINEERS	0/82
ASSOCIATED ELECTRIC COOP THOMAS HILL	3	NEW	670.0	LIMESTONE PULLMAN KELLOGG	1/82
BASIN ELECTRIC POWER COOP ANTELOPE VALLEY	1	NEW	440.0	LIME (DRY COLLECTION) JOY MFG. CO, WESTERN PRECIPITA	11/81
BASIN ELECTRIC POWER COOP LARAMIE RIVER	3	NEW	600.0	LIME (DRY COLLECTION) BABCOCK & WILCOX	4/82
EAST KENTUCKY POWER COOP SPURLOCK	2	NEW	500.0	LIME ADL/COMBUSTION EQUIP ASSOCIATE	3/80
LAKELAND UTILITIES MCINTOSH	3	NEW	364.0	LIMESTONE BABCOCK & WILCOX	10/81
LOUISVILLE GAS & ELECTRIC MILL CREEK	2	RETROFIT	350.0	LIME/LIMESTONE COMBUSTION ENGINEERING	4/82
MONTANA POWER COLSTRIP	3	NEW	700.0	LIME/ALKALINE FLYASH ADL/COMBUSTION EQUIP ASSOCIATE	7/80
MONTANA POWER COLSTRIP	4	NEW	700.0	LIME/ALKALINE FLYASH ADL/COMBUSTION EQUIP ASSOCIATE	7/81
NIAGARA MOHAWK POWER COOP CHARLES R. HUNTLEY	66	RETROFIT	100.0	AQUEOUS CARBONATE ROCKWELL INTERNATIONAL	0/82
PUBLIC SERVICE OF NEW MEXICO SAN JUAN	3	NEW	534.0	WELLMAN LORD DAVY POWERGAS	6/79
PUBLIC SERVICE OF NEW MEXICO SAN JUAN	4	NEW	534.0	WELLMAN LORD DAVY POWERGAS	1/82
SOUTH CAROLINA PUBLIC SERVICE WINYAH	3	NEW	300.0	LIMESTONE BABCOCK & WILCOX	5/80
SOUTHERN CALIFORNIA EDISON ALAMITOS	6	RETROFIT	175.0	LIME SO. CALIFRONIA EDISON/STEARNS	1/82
SOUTHWESTERN ELECTRIC POWER HENRY W. PERKEY	1	NEW	720.0	LIMESTONE AIR CORRECTION DIVISION, UOP	2/84
TENNESSEE VALLEY AUTHORITY PARADISE	1	RETROFIT	704.0	LIMESTONE VENDOR NOT SELECTED	0/82
TENNESSEE VALLEY AUTHORITY PARADISE	2	RETROFIT	704.0	LIMESTONE VENDOR NOT SELECTED	4/82
TEXAS MUNICIPAL POWER AGENCY GIBBONS CREEK	1	NEW	400.0	LIMESTONE COMBUSTION ENGINEERING	1/82
TEXAS UTILITIES MARTIN LAKE	4	NEW	750.0	LIMESTONE RESEARCH COTTRELL	0/85
WISCONSIN POWER & LIGHT COLUMBIA	2	NEW	316.0	LIME/ALKALINE FLYASH CHEMICO	1/80

SECTION 12
SUMMARY OF PLANNED FGD SYSTEMS

COMPANY NAME/ UNIT NAME	UNIT NO.	NEW OR RETROFIT	CAPACITY MW	PROCESS/ SYSTEM SUPPLIER	START-UP DATE
LETTER OF INTENT SIGNED					
NORTHERN STATES POWER SHERBURNE	3	NEW	720.0	LIMESTONE COMBUSTION ENGINEERING	5/84
PHILADELPHIA ELECTRIC EDDYSTONE	1B	RETROFIT	240.0	MAGNESIUM OXIDE UNITED ENGINEERS	6/80
REQUESTING/EVALUATING BIDS					
CENTRAL ILLINOIS LIGHT DUCK CREEK	2	NEW	416.0	LIMESTONE VENDOR NOT SELECTED	1/84
HOUSTON LIGHTING & POWER CO. W.A. PARISH	8	NEW	512.0	LIMESTONE VENDOR NOT SELECTED	10/82
MIDDLE SOUTH UTILITIES ARKANSAS COAL	5	NEW	890.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	1/86
MIDDLE SOUTH UTILITIES ARKANSAS COAL	6	NEW	890.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	1/88
MIDDLE SOUTH UTILITIES LOUISIANA COAL	1	NEW	890.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	0/86
MIDDLE SOUTH UTILITIES LOUISIANA COAL	2	NEW	890.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	0/88
MIDDLE SOUTH UTILITIES MISSISSIPPI COAL	1	NEW	890.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	0/85
MIDDLE SOUTH UTILITIES MISSISSIPPI COAL	2	NEW	890.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	0/87
PUBLIC SERVICE OF INDIANA GIBSON	5	NEW	650.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	0/82
TENNESSEE VALLEY AUTHORITY JOHNSONVILLE	1-10	RETROFIT	600.0	MAGNESIUM OXIDE TVA/UNITED ENGINEERS	0/82
TEXAS UTILITIES FOREST GROVE	1	NEW	750.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	0/81
CONSIDERING FGD SYSTEMS					
ALLEGHENY POWER SYSTEM MITCHELL	3	RETROFIT	300.0		8/82
BASIN ELECTRIC POWER COOP ANTELOPE VALLEY	2		440.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	11/83
CENTRAL MAINE POWER SEARS ISLAND	1	NEW	600.0	LIME OR LIMESTONE VENDOR NOT SELECTED	11/87
COLUMBUS & SOUTHERN OHIO ELEC. POSTON	5	NEW	375.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	0/83
COLUMBUS & SOUTHERN OHIO ELEC. POSTON	6	NEW	375.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	0/85
GENERAL PUBLIC UTILITIES COHO	1	NEW	800.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	5/88
GENERAL PUBLIC UTILITIES SEWARD	7	NEW	800.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	5/85
LOUISVILLE GAS & ELECTRIC TRIMBLE COUNTY	1	NEW	575.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	7/84
LOUISVILLE GAS & ELECTRIC TRIMBLE COUNTY	2	NEW	575.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	0/84

SECTION 12
SUMMARY OF PLANNED FGD SYSTEMS

COMPANY NAME/ UNIT NAME	UNIT NO.	NEW OR RETROFIT	CAPACITY MW	PROCESS/ SYSTEM SUPPLIER	START-UP DATE
NEVADA POWER HARRY ALLEN	1	NEW	500.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	6/85
NEVADA POWER HARRY ALLEN	2	NEW	500.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	6/86
NEVADA POWER HARRY ALLEN	3	NEW	500.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	6/87
NEVADA POWER HARRY ALLEN	4	NEW	500.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	6/88
NEVADA POWER REID GARDNER	4	NEW	250.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	0/83
NEVADA POWER WARNER VALLEY	1	NEW	250.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	6/84
NEVADA POWER WARNER VALLEY	2	NEW	250.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	6/85
NORTHERN INDIANA PUB SERVICE BAILLY	7	RETROFIT	190.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	0/ 0
NORTHERN INDIANA PUB SERVICE BAILLY	8	RETROFIT	400.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	0/ 0
PACIFIC GAS & ELECTRIC FOSSIL	1	NEW	800.0	LIMESTONE VENDOR NOT SELECTED	0/85
PACIFIC GAS & ELECTRIC FOSSIL	2	NEW	800.0	LIMESTONE VENDOR NOT SELECTED	0/86
PHILADELPHIA ELECTRIC CROMBY		RETROFIT	150.0	MAGNESIUM OXIDE UNITED ENGINEERS	6/80
PHILADELPHIA ELECTRIC EDDYSTONE	2	RETROFIT	334.0	MAGNESIUM OXIDE UNITED ENGINEERS	6/80
POTOMAC ELECTRIC POWER DICKERSON	4	NEW	800.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	5/85
POWER AUTHORITY OF NEW YORK ARTHUR KILL		NEW	700.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	11/88
SALT RIVER PROJECT CORONADO	3	NEW	280.0	LIMESTONE VENDOR NOT SELECTED	0/87
SEMINOLE ELECTRIC SEMINOLE	1	NEW	620.0	LIMESTONE VENDOR NOT SELECTED	6/83
SOUTHERN ILLINOIS POWER COOP MARION	5	NEW	300.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	0/84
TAMPA ELECTRIC BIG BEND	4	NEW	450.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	0/85
TENNESSEE VALLEY AUTHORITY CUMBERLAND		RETROFIT	600.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	7/82
TEXAS POWER & LIGHT TWIN OAKS	1	NEW	750.0	LIMESTONE VENDOR NOT SELECTED	8/83
TEXAS POWER & LIGHT TWIN OAKS	2	NEW	750.0	LIMESTONE VENDOR NOT SELECTED	9/84
TEXAS UTILITIES MILL CREEK	1	NEW	750.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	0/85
TEXAS UTILITIES MILL CREEK	2	NEW	750.0	PROCESS NOT SELECTED VENDOR NOT SELECTED	0/86

SECTION 13
TOTAL FGD UNITS AND CAPACITY (MW) INSTALLED BY YEAR

YEAR	NEW ON LINE NO.	NEW ON LINE MW	TERMINATED NO.	TERMINATED MW	TOTAL ON LINE NO.	TOTAL ON LINE MW
1968	1	0.	0	0.	1	0.
1971	3	420.	0	0.	4	420.
1972	8	240.	0	0.	12	660.
1973	7	1473.	1	0.	18	2133.
1974	3	250.	0	0.	21	2383.
1975	6	1971.	0	0.	27	4354.
1976	8	2051.	1	0.	34	6405.
1977	10	4664.	0	0.	44	11069.
1978	13	4704.	0	0.	57	15773.
1979	22	7198.	0	0.	79	22971.
1980	24	9453.	0	0.	103	32424.
1981	9	4630.	0	0.	112	37054.
1982	17	8850.	0	0.	129	45904.
1983	6	2965.	0	0.	135	48869.
1984	8	4306.	1	250.	142	52925.
1985	10	6365.	0	0.	152	59290.
1986	5	3830.	0	0.	157	63120.
1987	5	2270.	0	0.	162	65390.
UNDEFINED	20	1240.				

SECTION 14
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL PARTICULATE SCRUBBERS

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COMPANY NAME                                        COMMONWEALTH EDISON
PLANT NAME                                          WILL COUNTY
UNIT NUMBER                                         1
CITY                                                ROMEOVILLE
STATE                                               ILLINOIS
REGULATORY CLASSIFICATION                           ******
PARTICULATE EMISSION LIMITATION - NG/J                 0.           (  .000 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                       774.           ( 1.800 LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW                  1147.0
GROSS UNIT GENERATING CAPACITY - MW                  167.0
NET UNIT GENERATING CAPACITY W/FGD - MW              137.0
NET UNIT GENERATING CAPACITY WO/FGD - MW                .0
EQUIVALENT SCRUBBED CAPACITY - MW                       .0

** BOILER DATA
    SUPPLIER                                        BABCOCK & WILCOX
    TYPE                                            WET BOTTOM, CYCLONE
    SERVICE LOAD                                    CYCLIC
    COMMERCIAL SERVICE DATE                          0/55
    MAXIMUM BOILER FLUE GAS FLOW - CU.M/S             363.36        ( 770000 ACFM)
    FLUE GAS TEMPERATURE - C                          179.4         ( 355 F)
    STACK HEIGHT - M                                  107.          ( 350 FT)
    STACK TOP DIAMETER - M                              3.8         ( 12.4 FT)

** FUEL DATA
    FUEL TYPE                                       COAL
    FUEL GRADE                                      ******
    AVERAGE HEAT CONTENT - KJ/KG                     22260.         (  9570 BTU/LB)
    RANGE HEAT CONTENT - BTU/LB                                      9,100 - 10,500
    AVERAGE ASH CONTENT - %                             7.40
    RANGE ASH CONTENT - %                           3 - 16
    AVERAGE MOISTURE CONTENT - %                    ********
    RANGE MOISTURE CONTENT - %                      ******
    AVERAGE SULFUR CONTENT - %                          1.50
    RANGE SULFUR CONTENT - %                        0.3 - 4.5
    AVERAGE CHLORIDE CONTENT - %                    ********
    RANGE CHLORIDE CONTENT - %                      ******
    FUEL FIRING RATE - M T/H                           77.1         ( 85 TPH)
    FUEL FIRING RATE - MW                             167

** ESP
    NUMBER                                          1
    TYPE                                            COLD SIDE
    SUPPLIER                                        WESTERN PRECIPITATION (JOY MANUFACTURING)
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %         79.0
    FLUE GAS TEMPERATURE - C                          179.4         (  355 F)

** PARTICULATE SCRUBBER
    NUMBER                                          2
    TYPE                                            ADJUSTABLE THROAT VENTURI
    SUPPLIER                                        BABCOCK & WILCOX
    SHELL MATERIAL                                  CARBON STEEL
    LINING MATERIAL                                 PLASITE AND KAOCRETE
    TYPE OF NOZZLES                                 STAINLESS STEEL
    FLUE GAS CAPACITY - CU.M/S                        181.7         ( 385000 ACFM)
    FLUE GAS TEMPERATURE - C                          179.4         (  355 F)
    LIQUID RECIRCULATION RATE - LITER/S               365.4         ( 5800 GPM)
    L/G RATIO - LITER/CU.M                              2.4         (18.0 GAL/1000ACF)
    PRESSURE DROP - KPA                                 2.2         (     9 IN-H2O)
    SUPERFICIAL GAS VELOCITY - M/S                     36.6         (  120.0 FT/S)
    PARTICULATE INLET LOAD - G/CU.M                      .4         (   .16 GR/SCF)
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %          98.0
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SECTION 14
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL PARTICULATE SCRUBBERS

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 COMPANY NAME                                  DETROIT EDISON
 PLANT NAME                                    ST. CLAIR
 UNIT NUMBER                                   6
 CITY                                          BELLE RIVER
 STATE                                         MICHIGAN
 REGULATORY CLASSIFICATION                     C
 PARTICULATE EMISSION LIMITATION - NG/J        ******         (****** LB/MMBTU)
 SO2 EMISSION LIMITATION - NG/J                 1376.         ( 3.200 LB/MMBTU)
 NET PLANT GENERATING CAPACITY - MW             1775.0
 GROSS UNIT GENERATING CAPACITY - MW             325.0
 NET UNIT GENERATING CAPACITY W/FGD - MW       *******
 NET UNIT GENERATING CAPACITY WO/FGD - MW           .0
 EQUIVALENT SCRUBBED CAPACITY - MW                  .0

 ** BOILER DATA
     SUPPLIER                                  COMBUSTION ENGINEERING
     TYPE                                      COAL FIRED TWO-STAGE SUPERHEATER
     SERVICE LOAD                              BASE
     COMMERCIAL SERVICE DATE                    0/61
     MAXIMUM BOILER FLUE GAS FLOW - CU.M/S     ********       (******* ACFM)
     FLUE GAS TEMPERATURE - C                    132.2        ( 270 F)
     STACK HEIGHT - M                          ******         (**** FT)
     STACK TOP DIAMETER - M                    *******        (***** FT)

 ** FUEL DATA
     FUEL TYPE                                 COAL
     FUEL GRADE                                SUBBITUMINOUS
     AVERAGE HEAT CONTENT - KJ/KG              *******        (****** BTU/LB)
     RANGE HEAT CONTENT - BTU/LB                               9,500 - 9,600
     AVERAGE ASH CONTENT - %                        4.00
     RANGE ASH CONTENT - %                     ******
     AVERAGE MOISTURE CONTENT - %              ********
     RANGE MOISTURE CONTENT - %                22 - 24
     AVERAGE SULFUR CONTENT - %                ********
     RANGE SULFUR CONTENT - %                  0.3 - 0.4
     AVERAGE CHLORIDE CONTENT - %              ********
     RANGE CHLORIDE CONTENT - %                ******
     FUEL FIRING RATE - M T/H                   120.6         (133 TPH)
     FUEL FIRING RATE - MW                     *****

 ** ESP

 ** MECHANICAL COLLECTOR

 ** PARTICULATE SCRUBBER
     NUMBER                                     2
     TYPE                                      VENTURI
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SECTION 14
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL PARTICULATE SCRUBBERS

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COMPANY NAME                                     MINNESOTA POWER & LIGHT
PLANT NAME                                       AURORA
UNIT NUMBER                                      1
CITY                                             AURORA
STATE                                            MINNESOTA
REGULATORY CLASSIFICATION                        ******
PARTICULATE EMISSION LIMITATION - NG/J             0.          (  .000 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                   ******        (****** LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW                116.0
GROSS UNIT GENERATING CAPACITY - MW              *******
NET UNIT GENERATING CAPACITY W/FGD - MW            58.0
NET UNIT GENERATING CAPACITY WO/FGD - MW             .0
EQUIVALENT SCRUBBED CAPACITY - MW                    .0

** BOILER DATA
     SUPPLIER                                    COMBUSTION ENGINEERING
     TYPE                                        PULVERIZED COAL
     SERVICE LOAD                                ******
     COMMERCIAL SERVICE DATE                      0/53
     MAXIMUM BOILER FLUE GAS FLOW - CU.M/S       ********      (******* ACFM)
     FLUE GAS TEMPERATURE - C                    *******       (**** F)
     STACK HEIGHT - M                            ******        (**** FT)
     STACK TOP DIAMETER - M                      *******       (***** FT)

** FUEL DATA
     FUEL TYPE                                   COAL
     FUEL GRADE                                  SUBBITUMINOUS
     AVERAGE HEAT CONTENT - KJ/KG                 20469.       (  8800 BTU/LB)
     RANGE HEAT CONTENT - BTU/LB                                 ******
     AVERAGE ASH CONTENT - %                     ********
     RANGE ASH CONTENT - %                       ******
     AVERAGE MOISTURE CONTENT - %                   26.70
     RANGE MOISTURE CONTENT - %                  ******
     AVERAGE SULFUR CONTENT - %                      1.37
     RANGE SULFUR CONTENT - %                    ******
     AVERAGE CHLORIDE CONTENT - %                ********
     RANGE CHLORIDE CONTENT - %                  ******
     FUEL FIRING RATE - M T/H                    *******       (*** TPH)
     FUEL FIRING RATE - MW                       *****

** PARTICULATE SCRUBBER
     NUMBER                                       1
     TYPE                                        ELBAIR SPRAY-IMPINGEMENT
     SUPPLIER                                    KREBS ENGINEERING
     SHELL MATERIAL                              316 ELC STAINLESS STEEL
     LINING MATERIAL                             FLAKE-POLYESTER
     BOILER LOAD/SCRUBBER - %                      100.0
     FLUE GAS CAPACITY - CU.M/S                    137.4       ( 291160 ACFM)
     FLUE GAS TEMPERATURE - C                      171.1       (  340 F)
     L/G RATIO - LITER/CU.M                          1.1       ( 8.3 GAL/1000ACF)
     PRESSURE DROP - KPA                              .7       (     3 IN-H2O)
     SUPERFICIAL GAS VELOCITY - M/S                  2.1       (    7.0 FT/S)
     PARTICULATE INLET LOAD - G/CU.M                 4.7       (  2.06 GR/SCF)
     PARTICULATE OUTLET LOAD - G/CU.M                 .1       (  .040 GR/SCF)
     SO2 INLET CONCENTRATION - PPM                 800.000
     SO2 OUTLET CONCENTRATION - PPM                500.000
     SO2 DESIGN REMOVAL EFFICIENCY - %              37.0
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                                      SECTION 14
                DESIGN AND PERFORMANCE DATA FOR OPERATIONAL PARTICULATE SCRUBBERS
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 COMPANY NAME                                      MINNESOTA POWER & LIGHT
 PLANT NAME                                        AURORA
 UNIT NUMBER                                       2
 CITY                                              AURORA
 STATE                                             MINNESOTA
 REGULATORY CLASSIFICATION                         ******
 PARTICULATE EMISSION LIMITATION - NG/J              0.          (  .000 LB/MMBTU)
 SO2 EMISSION LIMITATION - NG/J                    ******        (****** LB/MMBTU)
 NET PLANT GENERATING CAPACITY - MW                 116.0
 GROSS UNIT GENERATING CAPACITY - MW               *******
 NET UNIT GENERATING CAPACITY W/FGD - MW             58.0
 NET UNIT GENERATING CAPACITY WO/FGD - MW              .0
 EQUIVALENT SCRUBBED CAPACITY - MW                     .0

 ** BOILER DATA
      SUPPLIER                                     COMBUSTION ENGINEERING
      TYPE                                         PULVERIZED COAL
      SERVICE LOAD                                 ******
      COMMERCIAL SERVICE DATE                       0/53
      MAXIMUM BOILER FLUE GAS FLOW - CU.M/S        ********      (******* ACFM)
      FLUE GAS TEMPERATURE - C                     *******       (**** F)
      STACK HEIGHT - M                             ******        (**** FT)
      STACK TOP DIAMETER - M                       *******       (***** FT)

 ** FUEL DATA
      FUEL TYPE                                    COAL
      FUEL GRADE                                   SUBBITUMINOUS
      AVERAGE HEAT CONTENT - KJ/KG                  20469.       (  8800 BTU/LB)
      RANGE HEAT CONTENT - BTU/LB                                  ******
      AVERAGE ASH CONTENT - %                      ********
      RANGE ASH CONTENT - %                        ******
      AVERAGE MOISTURE CONTENT - %                    26.70
      RANGE MOISTURE CONTENT - %                   ******
      AVERAGE SULFUR CONTENT - %                       1.37
      RANGE SULFUR CONTENT - %                     ******
      AVERAGE CHLORIDE CONTENT - %                 ********
      RANGE CHLORIDE CONTENT - %                   ******
      FUEL FIRING RATE - M T/H                     *******       (*** TPH)
      FUEL FIRING RATE - MW                        *****

 ** PARTICULATE SCRUBBER
      NUMBER                                        1
      TYPE                                         ELBAIR SPRAY-IMPINGEMENT
      SUPPLIER                                     KREBS ENGINEERING
      SHELL MATERIAL                               316 ELC STAINLESS STEEL
      LINING MATERIAL                              FLAKE-POLYESTER
      BOILER LOAD/SCRUBBER - %                       100.0
      FLUE GAS CAPACITY - CU.M/S                     137.4       ( 291160 ACFM)
      FLUE GAS TEMPERATURE - C                       171.1       (   340 F)
      L/G RATIO - LITER/CU.M                           1.1       ( 8.3 GAL/1000ACF)
      PRESSURE DROP - KPA                               .7       (      3 IN-H2O)
      SUPERFICIAL GAS VELOCITY - M/S                   2.1       (    7.0 FT/S)
      PARTICULATE INLET LOAD - G/CU.M                  4.7       (  2.06 GR/SCF)
      PARTICULATE OUTLET LOAD - G/CU.M                  .1       (  .040 GR/SCF)
      SO2 INLET CONCENTRATION - PPM                800.000
      SO2 OUTLET CONCENTRATION - PPM               500.000
      SO2 DESIGN REMOVAL EFFICIENCY - %              37.0
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SECTION 14
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL PARTICULATE SCRUBBERS

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COMPANY NAME                                  MONTANA-DAKOTA UTILITIES CO.
PLANT NAME                                    LEWIS & CLARK
UNIT NUMBER                                   ******
CITY                                          ******
STATE                                         ******
REGULATORY CLASSIFICATION                     ******
PARTICULATE EMISSION LIMITATION - NG/J            0.        (  .000 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                ******        (****** LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW            *******
GROSS UNIT GENERATING CAPACITY - MW           *******
NET UNIT GENERATING CAPACITY W/FGD - MW       *******
NET UNIT GENERATING CAPACITY WO/FGD - MW           .0
EQUIVALENT SCRUBBED CAPACITY - MW                  .0

** BOILER DATA
    SUPPLIER                                  ******
    TYPE                                      ******
    SERVICE LOAD                              ******
    COMMERCIAL SERVICE DATE                   **/**
    MAXIMUM BOILER FLUE GAS FLOW - CU.M/S     ********      (******* ACFM)
    FLUE GAS TEMPERATURE - C                  *******       (**** F)
    STACK HEIGHT - M                          ******        (**** FT)
    STACK TOP DIAMETER - M                    *******       (***** FT)

** FUEL DATA
    FUEL TYPE                                 COAL
    FUEL GRADE                                LIGNITE
    AVERAGE HEAT CONTENT - KJ/KG              *******       (****** BTU/LB)
    RANGE HEAT CONTENT - BTU/LB                              ******
    AVERAGE ASH CONTENT - %                       9.00
    RANGE ASH CONTENT - %                     ******
    AVERAGE MOISTURE CONTENT - %              ********
    RANGE MOISTURE CONTENT - %                ******
    AVERAGE SULFUR CONTENT - %                     .45
    RANGE SULFUR CONTENT - %                  ******
    AVERAGE CHLORIDE CONTENT - %              ********
    RANGE CHLORIDE CONTENT - %                ******
    FUEL FIRING RATE - M T/H                  *******       (*** TPH)
    FUEL FIRING RATE - MW                     *****

** MECHANICAL COLLECTOR
    NUMBER                                     1

** PARTICULATE SCRUBBER
    TYPE                                      VENTURI-FLOODED DISC
    SUPPLIER                                  RESEARCH COTTERELL
    L/G RATIO - LITER/CU.M                       1.7        (13.0 GAL/1000ACF)
    PRESSURE DROP - KPA                          3.2        (   13 IN-H2O)
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SECTION 14
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL PARTICULATE SCRUBBERS

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 COMPANY NAME                                        PACIFIC POWER & LIGHT
 PLANT NAME                                          DAVE JOHNSTON
 UNIT NUMBER                                         4
 CITY                                                GLENROCK
 STATE                                               WYOMING
 REGULATORY CLASSIFICATION                           ******
 PARTICULATE EMISSION LIMITATION - NG/J                 0.        (  .000 LB/MMBTU)
 SO2 EMISSION LIMITATION - NG/J                      ******       (****** LB/MMBTU)
 NET PLANT GENERATING CAPACITY - MW                  *******
 GROSS UNIT GENERATING CAPACITY - MW                 *******
 NET UNIT GENERATING CAPACITY W/FGD - MW               330.0
 NET UNIT GENERATING CAPACITY WO/FGD - MW                 .0
 EQUIVALENT SCRUBBED CAPACITY - MW                        .0

 ** BOILER DATA
     SUPPLIER                                        COMBUSTION ENGINEERING
     TYPE                                            PULVERIZED, COAL
     SERVICE LOAD                                    ******
     COMMERCIAL SERVICE DATE                         **/**
     MAXIMUM BOILER FLUE GAS FLOW - CU.M/S           ********     (******* ACFM)
     FLUE GAS TEMPERATURE - C                        *******      (**** F)
     STACK HEIGHT - M                                  76.        ( 250 FT)
     STACK TOP DIAMETER - M                          *******      (***** FT)

 ** FUEL DATA
     FUEL TYPE                                       COAL
     FUEL GRADE                                      SURBITUMINOUS
     AVERAGE HEAT CONTENT - KJ/KG                     17282.      (  7430 BTU/LB)
     RANGE HEAT CONTENT - BTU/LB                                   ******
     AVERAGE ASH CONTENT - %                            12.00
     RANGE ASH CONTENT - %                           ******
     AVERAGE MOISTURE CONTENT - %                       26.00
     RANGE MOISTURE CONTENT - %                      ******
     AVERAGE SULFUR CONTENT - %                           .50
     RANGE SULFUR CONTENT - %                        ******
     AVERAGE CHLORIDE CONTENT - %                         .04
     RANGE CHLORIDE CONTENT - %                      ******
     FUEL FIRING RATE - M T/H                        *******      (*** TPH)
     FUEL FIRING RATE - MW                           *****

 ** ESP

 ** PARTICULATE SCRUBBER
     NUMBER                                           3
     TYPE                                            VENTURI
     SUPPLIER                                        CHEMICO
     LINING MATERIAL                                 POLYESTER-LINED STEEL
     FLUE GAS CAPACITY - CU.M/S                        327.5      ( 694000 ACFM)
     FLUE GAS TEMPERATURE - C                          135.0      (  275 F)
     LIQUID RECIRCULATION RATE - LITER/S               409.5      ( 6500 GPM)
     L/G RATIO - LITER/CU.M                              1.3      ( 9.4 GAL/1000ACF)
     PRESSURE DROP - KPA                                 2.5      (   10 IN-H2O)
     PARTICULATE INLET LOAD - G/CU.M                     9.2      (  4.00 GR/SCF)
     PARTICULATE DESIGN REMOVAL EFFICIENCY - %          99.7
     SO2 INLET CONCENTRATION - PPM                     459.000
     SO2 DESIGN REMOVAL EFFICIENCY - %                  40.0
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SECTION 14
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL PARTICULATE SCRUBBERS

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COMPANY NAME                                    POTOMAC ELECTRIC POWER
PLANT NAME                                      CHALK POINT
UNIT NUMBER                                     4
CITY                                            ******
STATE                                           MARYLNAD
REGULATORY CLASSIFICATION                       ******
PARTICULATE EMISSION LIMITATION - NG/J            0.          (  .000 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                  ******        (****** LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW               1892.0
GROSS UNIT GENERATING CAPACITY - MW               630.0
NET UNIT GENERATING CAPACITY W/FGD - MW           630.0
NET UNIT GENERATING CAPACITY WO/FGD - MW            .0
EQUIVALENT SCRUBBED CAPACITY - MW                   .0

** BOILER DATA
    SUPPLIER                                    ******
    TYPE                                        ******
    SERVICE LOAD                                BASE
    COMMERCIAL SERVICE DATE                     **/**
    MAXIMUM BOILER FLUE GAS FLOW - CU.M/S       ********      (******* ACFM)
    FLUE GAS TEMPERATURE - C                    *******       (**** F)
    STACK HEIGHT - M                            ******        (**** FT)
    STACK TOP DIAMETER - M                      *******       (***** FT)

** FUEL DATA
    FUEL TYPE                                   OIL
    FUEL GRADE                                  ******
    AVERAGE HEAT CONTENT - KJ/KG                *******       (****** BTU/LB)
    RANGE HEAT CONTENT - BTU/LB                                ******
    AVERAGE ASH CONTENT - %                     ********
    RANGE ASH CONTENT - %                       ******
    AVERAGE MOISTURE CONTENT - %                ********
    RANGE MOISTURE CONTENT - %                  ******
    AVERAGE SULFUR CONTENT - %                  ********
    RANGE SULFUR CONTENT - %                    ******
    AVERAGE CHLORIDE CONTENT - %                ********
    RANGE CHLORIDE CONTENT - %                  ******
    FUEL FIRING RATE - M T/H                    *******       (*** TPH)
    FUEL FIRING RATE - MW                       *****
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SECTION 14
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL PARTICULATE SCRUBBERS

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COMPANY NAME                                   POTOMAC ELECTRIC POWER
PLANT NAME                                     DICKERSON
UNIT NUMBER                                    3
CITY                                           DICKERSON
STATE                                          MARYLAND
REGULATORY CLASSIFICATION                      ******
PARTICULATE EMISSION LIMITATION - NG/J            0.         (  .000 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                  688.         ( 1.600 LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW               548.0
GROSS UNIT GENERATING CAPACITY - MW              190.0
NET UNIT GENERATING CAPACITY W/FGD - MW          183.0
NET UNIT GENERATING CAPACITY WO/FGD - MW            .0
EQUIVALENT SCRUBBED CAPACITY - MW                   .0

** BOILER DATA
   SUPPLIER                                    COMBUSTION ENGINEERING
   TYPE                                        DRY BOTTOM, PULVERIZED COAL
   SERVICE LOAD                                BASE
   COMMERCIAL SERVICE DATE                      0/62
   MAXIMUM BOILER FLUE GAS FLOW - CU.M/S         278.42      ( 590000 ACFM)
   FLUE GAS TEMPERATURE - C                      126.1       ( 259 F)
   STACK HEIGHT - M                              122.        ( 400 FT)
   STACK TOP DIAMETER - M                      *******       (***** FT)

** FUEL DATA
   FUEL TYPE                                   COAL
   FUEL GRADE                                  ******
   AVERAGE HEAT CONTENT - KJ/KG                 27214.       ( 11700 BTU/LB)
   RANGE HEAT CONTENT - BTU/LB                                 ******
   AVERAGE ASH CONTENT - %                         14.00
   RANGE ASH CONTENT - %                       ******
   AVERAGE MOISTURE CONTENT - %                ********
   RANGE MOISTURE CONTENT - %                  ******
   AVERAGE SULFUR CONTENT - %                       2.00
   RANGE SULFUR CONTENT - %                    ******
   AVERAGE CHLORIDE CONTENT - %                ********
   RANGE CHLORIDE CONTENT - %                  ******
   FUEL FIRING RATE - M T/H                       67.1       ( 74 TPH)
   FUEL FIRING RATE - MW                       *****

** ESP
   NUMBER                                       1
   SUPPLIER                                    RESEARCH-COTTRELL
   PARTICULATE DESIGN REMOVAL EFFICIENCY - %      94.0

** PARTICULATE SCRUBBER
   NUMBER                                       1
   TYPE                                        ADJUSTABLE VENTURI
   SUPPLIER                                    CHEMICO
   BOILER LOAD/SCRUBBER - %                       50.0
   FLUE GAS CAPACITY - CU.M/S                    139.2       ( 295000 ACFM)
   FLUE GAS TEMPERATURE - C                      126.1       (  259 F)
   L/G RATIO - LITER/CU.M                          2.7       (20.0 GAL/1000ACF)
   PRESSURE DROP - KPA                             2.7       (    11 IN-H2O)
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SECTION 14
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL PARTICULATE SCRUBBERS

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COMPANY NAME                                     PUBLIC SERVICE OF COLORADO
PLANT NAME                                       ARAPAHOE
UNIT NUMBER                                      4
CITY                                             DENVER
STATE                                            COLORADO
REGULATORY CLASSIFICATION                        ******
PARTICULATE EMISSION LIMITATION - NG/J              0.          (  .000 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                   ******         (****** LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW               *******
GROSS UNIT GENERATING CAPACITY - MW              *******
NET UNIT GENERATING CAPACITY W/FGD - MW            112.0
NET UNIT GENERATING CAPACITY WO/FGD - MW              .0
EQUIVALENT SCRUBBED CAPACITY - MW                     .0

** BOILER DATA
    SUPPLIER                                     ******
    TYPE                                         PULVERIDED, COAL
    SERVICE LOAD                                 ******
    COMMERCIAL SERVICE DATE                       0/55
    MAXIMUM BOILER FLUE GAS FLOW - CU.M/S        ********       (******* ACFM)
    FLUE GAS TEMPERATURE - C                     *******        (**** F)
    STACK HEIGHT - M                             ******         (**** FT)
    STACK TOP DIAMETER - M                       *******        (***** FT)

** FUEL DATA
    FUEL TYPE                                    COAL
    FUEL GRADE                                   SUBBITUMINOUS
    AVERAGE HEAT CONTENT - KJ/KG                  23725.        ( 10200 BTU/LB)
    RANGE HEAT CONTENT - BTU/LB                                   ******
    AVERAGE ASH CONTENT - %                           9.30
    RANGE ASH CONTENT - %                        ******
    AVERAGE MOISTURE CONTENT - %                     13.70
    RANGE MOISTURE CONTENT - %                   ******
    AVERAGE SULFUR CONTENT - %                         .95
    RANGE SULFUR CONTENT - %                     ******
    AVERAGE CHLORIDE CONTENT - %                       .01
    RANGE CHLORIDE CONTENT - %                   ******
    FUEL FIRING RATE - M T/H                     *******        (*** TPH)
    FUEL FIRING RATE - MW                        *****

** FUEL DATA
    FUEL TYPE                                    COAL
    FUEL GRADE                                   ******
    AVERAGE HEAT CONTENT - KJ/KG                  23493.        ( 10100 BTU/LB)
    RANGE HEAT CONTENT - BTU/LB                                   ******
    AVERAGE ASH CONTENT - %                          12.50
    RANGE ASH CONTENT - %                        ******
    AVERAGE MOISTURE CONTENT - %                     11.20
    RANGE MOISTURE CONTENT - %                   ******
    AVERAGE SULFUR CONTENT - %                         .65
    RANGE SULFUR CONTENT - %                     ******
    AVERAGE CHLORIDE CONTENT - %                       .01
    RANGE CHLORIDE CONTENT - %                   ******
    FUEL FIRING RATE - M T/H                     *******        (*** TPH)
    FUEL FIRING RATE - MW                        *****

** ESP
    NUMBER                                         1

** MECHANICAL COLLECTOR
    NUMBER                                         1

** PARTICULATE SCRUBBER
    NUMBER                                         1
    TYPE                                         TCA
    SUPPLIER                                     UOP
    NUMBER OF STAGES                                 3
    SHELL MATERIAL                               CARBON STEEL
    LINING MATERIAL                              RUBBER
    INTERNAL MATERIAL                            STAINLESS STEEL
    L/G RATIO - LITER/CU.M                           7.5        (56.0 GAL/1000ACF)
    SUPERFICIAL GAS VELOCITY - M/S                   3.4        (   11.0 FT/S)
    PARTICULATE INLET LOAD - G/CU.M                  1.8        (   .80 GR/SCF)
    PARTICULATE OUTLET LOAD - G/CU.M                  .0        (  .020 GR/SCF)
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %       93.0
    SO2 INLET CONCENTRATION - PPM                  500.000
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DESIGN AND PERFORMANCE DATA FOR OPERATIONAL PARTICULATE SCRUBBERS

SO_2 OUTLET CONCENTRATION - PPM	350.000
SO_2 DESIGN REMOVAL EFFICIENCY - %	30.0

SECTION 14
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL PARTICULATE SCRUBBERS

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COMPANY NAME                                PUBLIC SERVICE OF COLORADO
PLANT NAME                                  CHEROKEE
UNIT NUMBER                                 1
CITY                                        DENVER
STATE                                       COLORADO
REGULATORY CLASSIFICATION                   ******
PARTICULATE EMISSION LIMITATION - NG/J          0.        (  .000 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J              ******        (****** LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW           710.0
GROSS UNIT GENERATING CAPACITY - MW          115.0
NET UNIT GENERATING CAPACITY W/FGD - MW      100.0
NET UNIT GENERATING CAPACITY WO/FGD - MW        .0
EQUIVALENT SCRUBBED CAPACITY - MW               .0

** BOILER DATA
     SUPPLIER                               BABCOCK & WILCOX
     TYPE                                   PULVERIZED COAL
     SERVICE LOAD                           ******
     COMMERCIAL SERVICE DATE                 0/57
     MAXIMUM BOILER FLUE GAS FLOW - CU.M/S  ********      (******* ACFM)
     FLUE GAS TEMPERATURE - C               *******       (**** F)
     STACK HEIGHT - M                       ******        (**** FT)
     STACK TOP DIAMETER - M                 *******       (***** FT)

** FUEL DATA
     FUEL TYPE                              COAL
     FUEL GRADE                             BITUMINOUS
     AVERAGE HEAT CONTENT - KJ/KG            23493.       ( 10100 BTU/LB)
     RANGE HEAT CONTENT - BTU/LB                            ******
     AVERAGE ASH CONTENT - %                    12.50
     RANGE ASH CONTENT - %                  ******
     AVERAGE MOISTURE CONTENT - %               11.30
     RANGE MOISTURE CONTENT - %             ******
     AVERAGE SULFUR CONTENT - %                   .65
     RANGE SULFUR CONTENT - %               ******
     AVERAGE CHLORIDE CONTENT - %                 .01
     RANGE CHLORIDE CONTENT - %             ******
     FUEL FIRING RATE - M T/H               *******       (*** TPH)
     FUEL FIRING RATE - MW                  *****

** ESP
     NUMBER                                  1

** MECHANICAL COLLECTOR
     NUMBER                                  1

** PARTICULATE SCRUBBER
     NUMBER                                  1
     TYPE                                   TCA
     SUPPLIER                               UOP
     NUMBER OF STAGES                          3
     SHELL MATERIAL                         CARBON STEEL
     LINING MATERIAL                        RUBBER
     INTERNAL MATERIAL                      STAINLESS STEEL
     BOILER LOAD/SCRUBBER - %                 67.0
     FLUE GAS CAPACITY - CU.M/S              164.4        ( 348400 ACFM)
     FLUE GAS TEMPERATURE - C                146.1        (  295 F)
     L/G RATIO - LITER/CU.M                    7.5        (56.0 GAL/1000ACF)
     PRESSURE DROP - KPA                       3.2        (    13 IN-H2O)
     SUPERFICIAL GAS VELOCITY - M/S            3.4        (   11.0 FT/S)
     PARTICULATE INLET LOAD - G/CU.M           1.8        (    .80 GR/SCF)
     PARTICULATE OUTLET LOAD - G/CU.M           .0        (  .020 GR/SCF)
     PARTICULATE DESIGN REMOVAL EFFICIENCY - %  97.0
     SO2 INLET CONCENTRATION - PPM           500.000
     SO2 OUTLET CONCENTRATION - PPM          420.000
     SO2 DESIGN REMOVAL EFFICIENCY - %        16.0
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SECTION 14
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL PARTICULATE SCRUBBERS

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COMPANY NAME                                    PUBLIC SERVICE OF COLORADO
PLANT NAME                                      CHEROKEE
UNIT NUMBER                                     3
CITY                                            DENVER
STATE                                           COLORADO
REGULATORY CLASSIFICATION                       ******
PARTICULATE EMISSION LIMITATION - NG/J             0.         (  .000 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                  ******        (****** LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW                710.0
GROSS UNIT GENERATING CAPACITY - MW               170.0
NET UNIT GENERATING CAPACITY W/FGD - MW           150.0
NET UNIT GENERATING CAPACITY WO/FGD - MW             .0
EQUIVALENT SCRUBBED CAPACITY - MW                    .0

** BOILER DATA
   SUPPLIER                                     BABCOCK & WILCOX
   TYPE                                         PULVERIZED, COAL
   SERVICE LOAD                                 ******
   COMMERCIAL SERVICE DATE                       0/62
   MAXIMUM BOILER FLUE GAS FLOW - CU.M/S        *********     (******* ACFM)
   FLUE GAS TEMPERATURE - C                     *******       (**** F)
   STACK HEIGHT - M                             ******        (**** FT)
   STACK TOP DIAMETER - M                       *******       (***** FT)

** FUEL DATA
   FUEL TYPE                                    COAL
   FUEL GRADE                                   BITUMINOUS
   AVERAGE HEAT CONTENT - KJ/KG                  23493.       ( 10100 BTU/LB)
   RANGE HEAT CONTENT - BTU/LB                                  ******
   AVERAGE ASH CONTENT - %                          12.50
   RANGE ASH CONTENT - %                        ******
   AVERAGE MOISTURE CONTENT - %                     11.30
   RANGE MOISTURE CONTENT - %                   ******
   AVERAGE SULFUR CONTENT - %                         .65
   RANGE SULFUR CONTENT - %                     ******
   AVERAGE CHLORIDE CONTENT - %                       .01
   RANGE CHLORIDE CONTENT - %                   ******
   FUEL FIRING RATE - M T/H                     *******       (*** TPH)
   FUEL FIRING RATE - MW                        *****

** ESP
   NUMBER                                       1

** MECHANICAL COLLECTOR
   NUMBER                                       1

** PARTICULATE SCRUBBER
   NUMBER                                       2
   TYPE                                         TCA
   SUPPLIER                                     UOP
   NUMBER OF STAGES                                3
   SHELL MATERIAL                               CARBON STEEL
   LINING MATERIAL                              RUBBER
   INTERNAL MATERIAL                            STAINLESS STEEL
   BOILER LOAD/SCRUBBER - %                       20.0
   FLUE GAS CAPACITY - CU.M/S                     57.6        ( 122000 ACFM)
   FLUE GAS TEMPERATURE - C                      137.8        (  280 F)
   L/G RATIO - LITER/CU.M                          7.5        (56.0 GAL/1000ACF)
   PRESSURE DROP - KPA                             3.2        (    13 IN-H2O)
   SUPERFICIAL GAS VELOCITY - M/S                  3.4        (    11.0 FT/S)
   PARTICULATE INLET LOAD - G/CU.M                  .9        (    .40 GR/SCF)
   PARTICULATE OUTLET LOAD - G/CU.M                 .0        (   .020 GR/SCF)
   PARTICULATE DESIGN REMOVAL EFFICIENCY - %      95.0
   SO2 INLET CONCENTRATION - PPM                 500.000
   SO2 OUTLET CONCENTRATION - PPM                420.000
   SO2 DESIGN REMOVAL EFFICIENCY - %              16.0
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SECTION 14
DESIGN AND PERFORMANCE DATA FOR OPERATIONAL PARTICULATE SCRUBBERS

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COMPANY NAME                                     PUBLIC SERVICE OF COLORADO
PLANT NAME                                       CHEROKEE
UNIT NUMBER                                      4
CITY                                             DENVER
STATE                                            COLORADO
REGULATORY CLASSIFICATION                        ******
PARTICULATE EMISSION LIMITATION - NG/J              0.           (  .000 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                   ******          (****** LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW                 710.0
GROSS UNIT GENERATING CAPACITY - MW                375.0
NET UNIT GENERATING CAPACITY W/FGD - MW            350.0
NET UNIT GENERATING CAPACITY WO/FGD - MW              .0
EQUIVALENT SCRUBBED CAPACITY - MW                     .0

** BOILER DATA
    SUPPLIER                                     COMBUSTION ENGINEERING
    TYPE                                         PULVERIZED COAL
    SERVICE LOAD                                 ******
    COMMERCIAL SERVICE DATE                       0/68
    MAXIMUM BOILER FLUE GAS FLOW - CU.M/S          717.29        (1520000 ACFM)
    FLUE GAS TEMPERATURE - C                       135.0         ( 275 F)
    STACK HEIGHT - M                             ******          (**** FT)
    STACK TOP DIAMETER - M                       *******         (***** FT)

** FUEL DATA
    FUEL TYPE                                    COAL
    FUEL GRADE                                   BITUMINOUS
    AVERAGE HEAT CONTENT - KJ/KG                  23493.         ( 10100 BTU/LB)
    RANGE HEAT CONTENT - BTU/LB                                   ******
    AVERAGE ASH CONTENT - %                          12.50
    RANGE ASH CONTENT - %                        ******
    AVERAGE MOISTURE CONTENT - %                     11.30
    RANGE MOISTURE CONTENT - %                   ******
    AVERAGE SULFUR CONTENT - %                         .65
    RANGE SULFUR CONTENT - %                     ******
    AVERAGE CHLORIDE CONTENT - %                       .01
    RANGE CHLORIDE CONTENT - %                   ******
    FUEL FIRING RATE - M T/H                     *******         (*** TPH)
    FUEL FIRING RATE - MW                        *****

** ESP
    NUMBER                                         1

** MECHANICAL COLLECTOR
    NUMBER                                         1

** PARTICULATE SCRUBBER
    NUMBER                                       4
    TYPE                                         TCA
    SUPPLIER                                     UOP
    NUMBER OF STAGES                                 3
    SHELL MATERIAL                               CARBON STEEL
    LINING MATERIAL                              RUBBER
    INTERNAL MATERIAL                            STAINLESS STEEL
    L/G RATIO - LITER/CU.M                           7.5         (56.0 GAL/1000ACF)
    PRESSURE DROP - KPA                              3.2         (   13 IN-H2O)
    SUPERFICIAL GAS VELOCITY - M/S                   3.4         (   11.0 FT/S)
    PARTICULATE INLET LOAD - G/CU.M                  1.6         (    .70 GR/SCF)
    PARTICULATE OUTLET LOAD - G/CU.M                  .0         (   .020 GR/SCF)
    PARTICULATE DESIGN REMOVAL EFFICIENCY - %       97.0
    SO2 INLET CONCENTRATION - PPM                  500.000
    SO2 OUTLET CONCENTRATION - PPM                 420.000
    SO2 DESIGN REMOVAL EFFICIENCY - %               16.0
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                                                SECTION 14
                         DESIGN AND PERFORMANCE DATA FOR OPERATIONAL PARTICULATE SCRUBBERS
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COMPANY NAME                                           PUBLIC SERVICE OF COLORADO
PLANT NAME                                             VALMONT
UNIT NUMBER                                            5
CITY                                                   VALMONT
STATE                                                  COLORADO
REGULATORY CLASSIFICATION                              ******
PARTICULATE EMISSION LIMITATION - NG/J                    0.            (  .000 LB/MMBTU)
SO2 EMISSION LIMITATION - NG/J                         ******           (****** LB/MMBTU)
NET PLANT GENERATING CAPACITY - MW                       273.8
GROSS UNIT GENERATING CAPACITY - MW                      166.0
NET UNIT GENERATING CAPACITY W/FGD - MW                  166.0
NET UNIT GENERATING CAPACITY WO/FGD - MW                    .0
EQUIVALENT SCRUBBED CAPACITY - MW                           .0

** BOILER DATA
     SUPPLIER                                          ******
     TYPE                                              PULVERIZED COAL
     SERVICE LOAD                                      BASE
     COMMERCIAL SERVICE DATE                            0/64
     MAXIMUM BOILER FLUE GAS FLOW - CU.M/S             ********         (******* ACFM)
     FLUE GAS TEMPERATURE - C                          *******          (**** F)
     STACK HEIGHT - M                                  ******           (**** FT)
     STACK TOP DIAMETER - M                            *******          (***** FT)

** FUEL DATA
     FUEL TYPE                                         COAL
     FUEL GRADE                                        SUBBITUMINOUS
     AVERAGE HEAT CONTENT - KJ/KG                      *******          (****** BTU/LB)
     RANGE HEAT CONTENT - BTU/LB                                         ******
     AVERAGE ASH CONTENT - %                               5.20
     RANGE ASH CONTENT - %                             ******
     AVERAGE MOISTURE CONTENT - %                      ********
     RANGE MOISTURE CONTENT - %                        ******
     AVERAGE SULFUR CONTENT - %                             .60
     RANGE SULFUR CONTENT - %                          ******
     AVERAGE CHLORIDE CONTENT - %                      ********
     RANGE CHLORIDE CONTENT - %                        ******
     FUEL FIRING RATE - M T/H                          *******          (*** TPH)
     FUEL FIRING RATE - MW                             *****

** ESP
     TYPE                                              COLD SIDE

** MECHANICAL COLLECTOR
```

APPENDIX A

FGD SYSTEM COST DATA: OPERATIONAL AND NONOPERATIONAL SYSTEMS

INTRODUCTION

The cost of flue gas desulfurization (FGD) systems for the control of sulfur dioxide emissions is an area of intense interest and substantial controversy. As a result, many computer models have recently been developed to estimate capital and annual costs. As part of an effort by the U.S. Environmental Protection Agency to provide meaningful economic data concerning FGD systems, reported economic data have been incorporated into the EPA Utility FGD Survey report. This information has appeared as a separate appendix of the report since October 1976. Until January 1978, this cost appendix consisted entirely of data reported by the utilities with little or no interpretation provided by PEDCo Environmental, Inc. Beginning with the May 1978 report, the format and content of the cost appendix were revised to include reported and adjusted costs for the operational FGD systems.

The rationale for including adjusted as well as reported costs stems primarily from the lack of comparability of the reported costs. Many of the reported cost figures, both capital and operating, are largely site-sensitive values that cannot be accurately compared because they refer to different FGD battery limits and different years in which the expenditures were made. As a result, an analysis of the cost data was made for the operational units since these systems offer the potential of having complete and accurate economic data. The adjustments were made to provide comparable, accurate cost data for the sulfur dioxide portion of the emission control system. This, in effect, will eliminate much of the confusion that exists concerning the reported data, and it will provide a common basis for the reported costs.

APPROACH

In March 1978, each utility having at least one operational FGD system was given a cost form containing all available cost information then in the PEDCo files. The utility was asked to verify the data and fill in any missing information called for on the form. A follow-up visit by the PEDCo Environmental staff was arranged to assist in data acquisition and to insure completeness and reliability of information. Results of the cost analysis were forwarded to each participating utility for final review and comment.

The cost data were treated solely to establish the accurate costs for FGD systems, on a common basis, not to critique the design or reasonableness of the costs reported by any utility. Adjustments focused primarily on the following items:

- All capital costs were adjusted to July 1, 1977, dollars using the Chemical Engineering Index. All capital costs, represented in dollars/kilowatt ($/kW), were expressed in terms of gross megawatts (MW). Actual costs were reported by utilities in dollar values for years 1970 to 1980. These values are represented in terms of the year of greatest capital expenditures.

- Gross unit capacity was used to express all FGD capital expenditures because the capital requirement of an FGD system is dependent on actual boiler size before derating for auxiliary and air quality control power requirements.

- Particulate control costs were deducted. Since the purpose of the study was to estimate the incremental cost for sulfur dioxide control, particulate control costs were deducted using either data contained in the cost breakdowns or as a percentage of the total direct cost (capital and annual). The percentage reduction varied depending upon system design and operation.

- The capital costs associated with the modification or installation of equipment not part of the FGD system but needed for its proper functioning, were included (e.g. - stack lining, modification to existing ductwork or fans, etc.).
- Indirect charges were adjusted to provide adequate funds for engineering, field expenses, legal expenses, insurance, interest during construction, allowance for startup, taxes, and contingency.
- All annual costs, represented in mills/kilowatt-hour (mills/kWh), were expressed in terms of net megawatts (MW).
- Net unit capacity was used to express all FGD annual expenditures because the annual cost requirement of an FGD system is dependent on the actual amount of kilowatt-hours (kWh) produced by the unit after derating for auxiliary and air quality control power requirements.
- All annual costs were adjusted to a common capacity factor (65%).
- Replacement power costs were not included since only a few utilities reported such costs and these were presented using a variety of methods.
- Sludge disposal costs were adjusted to reflect the costs of sulfur dioxide waste disposal only (i.e., excluding fly ash disposal) and to provide for disposal over the anticipated lifetime of the FGD system. This latter correction was necessary since several utilities reported costs for sludge disposal capacity that would last only a fraction of the FGD system life. The adjustments were based on a land cost of $2000/acre with a sludge depth of 50 ft in a clay-lined pond (clay is assumed to be available at the site).
- A 30-year life was assumed for all process and economic considerations for all new systems that were installed for the life of the unit. A 20-year life was assumed for all process and economic considerations for retro-

fit systems that were installed for the remaining portion of the life of the unit.*

- Regeneration and by-product recovery facility costs were added for those regenerable systems not reporting such costs.

To the extent possible, all cost adjustments were made using the previous assumptions developed by PEDCo Environmental. When cost data were inadequate, adjustments were made using process design data in conjunction with the previous cost assumptions. In some cases, no adjustments were possible because of insufficient data.

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* The use of a 30-year service life for new units coincides with the conclusion of the National Power Survey of the Federal Power Commission which recognized this value as reasonable for steam-electric plants. A 20-year service life was assumed for all retrofit units even if the remaining life of the units is less than this value. Thus, two different rates are used and should be noted when making comparisons between new and retrofit systems.

DESCRIPTION OF COST ELEMENTS

Capital costs consist of direct costs, indirect costs, contingency costs, and other capital costs. Direct costs include the "bought-out" cost of the equipment, the cost of installation, and site development. Indirect costs include interest during construction, contractor's fees and expenses, engineering, legal expenses, taxes, insurance, allowance for start-up and shakedown, and spares. Contingency costs include those costs resulting from malfunctions, equipment alterations, and similar unforeseen sources. Other capital costs include the nondepreciable items of land and working capital.

Annual costs consist of direct costs, fixed costs, and overhead costs. Direct costs include the cost of raw materials, utilities, operating labor and supervision, and maintenance and repairs. Fixed costs include those of depreciation, interim replacement, insurance, taxes, and interest on borrowed capital. Overhead costs include those of plant and payroll expenses. The various capital and annual cost components are discussed and defined in greater detail in the following paragraphs.

The direct capital costs include the following elements:

- Equipment required for the FGD system. Table A-1 provides a summary of the major process equipment used in regenerable and nonregenerable systems.
- Installation of equipment, including foundations; steel work for support, buildings, piping and ducting for effluents, slurries, sludge, and make-up water, control panels, instrumentation, insulation of ducting, buildings, piping, and other equipment, painting and piling.
- Site development may include clearing and grading, construction of access roads and walkways, establishment of rail, barge, and/or truck facilities, and parking facilities.

TABLE A-1. MAJOR FGD SYSTEM EQUIPMENT SUMMARY

Category	Description
Material handling-raw materials	Equipment for the handling and transfer of raw materials includes unloading facilities, conveyors, storage areas and silos, vibrators, atmospheric emission control associated with these facilities, and related accessories.
Feed preparation-raw materials	Equipment for the preparation of raw material to produce a feed slurry consists of feed weighers, crushers, grinders, classifiers, ball mills, mixing tanks, pumps, agitators, and related accessories.
Sulfur dioxide absorption	Equipment for treating the flue gas includes absorbers, mist eliminators, hold tanks, agitators, circulating pumps, pond water return pumps, and related accessories.
Flue gas reheat	Equipment required includes air, steam, or hot water heaters, condensate tanks, pumps, soot blowers, fans, fuel storage facilities, gas bypass equipment, and related accessories.
Gas handling	Equipment to handle the boiler flue gas includes booster fans, ductwork, flue gas bypass system, turning vanes, supports, platforms, and related accessories.
Sludge disposal	Nonregenerable FGD systems require solids/water separation equipment such as clarifiers, vacuum filters, centrifuges, sludge fixation equipment, and related accessories.
Utilities	Equipment to supply power and water to the FGD equipment consists of switch-gear, breakers, transformers, piping, and related accessories.
By-product handling	Equipment for processing the by-product of regenerable FGD systems may include a rotary kiln, fluid bed dryer, conveyor, storage silo, vibrator, combustion equipment and oil storage tanks, waste heat boilers, hammer mills, evaporators, crystallizers, strippers, tanks, agitators, pumps, compressors, sulfuric acid absorber and cooling, mist eliminator, pumps, acid coolers, tanks, etc.

(continued)

TABLE A-1. (continued)

Category	Description
Regeneration	Equipment for regeneration of the absorbing medium of an FGD system may consist of reactor vessels, material handling system, storage, weigh feeder, conveyor, rotary kiln, fluid bed calciner, dust collector, storage silo, vibrator, combustion equipment and oil storage tanks, waste heat boiler, hammer mill, evaporators, crystallizers, strippers, tanks, agitators, pumps, compressors, sulfuric acid absorber and cooling, mist eliminator, pumps, acid coolers, tanks, etc.
Purge treatment	Equipment for the removal of purge material (e.g. sodium sulfate) includes refrigeration, pumps, tanks, crystallizer, centrifuge, dryer, dust collector, conveyors, storage, and related equipment.
Auxiliary	Equipment not directly related to the FGD system, but which may require design or modification to accommodate an FGD system may include such items as existing fans, ducts, or stack. If new fans, ducts, or stacks are added to improve boiler performance and accommodate the FGD system, the costs are prorated to the boiler and FGD system.

Indirect capital costs include the following elements:

- Interest accrued on borrowed capital during construction.
- Contractor's fee and expenses, including costs for field labor payroll; field office supervision; personnel; construction offices; temporary roadways; railroad trackage; maintenance and welding shops; parking lot; communications; temporary piping and electrical and sanitary facilities; safety security (fire, material, medical, etc.); construction tools and rental equipment; unloading and storage of materials; travel expenses; permits; licenses; taxes; insurance; overhead; legal liabilities; field testing of equipment; start-up; and labor relations.
- Engineering costs, including administrative, process, project, and general; design and related functions for specifications; bid analysis; special studies; cost analysis; accounting; reports; consultant fees; purchasing; procurement; travel expenses; living expenses; expediting; inspection; safety; communications; modeling; pilot plant studies (if required because of process design or application novelty); royalty payments during construction; training of plant personnel; field engineering; safety engineering; and consultant services.
- Legal expenses, including those for securing permits, rights-of-way, etc.
- Taxes, including sales, and excise taxes.
- Insurance covering liability for equipment in transit and at site; fire, casualty, injury, and death; damage to property; delay; and noncompliance.
- Allowance for start-up and shakedown includes the cost associated with system start-up.
- Spare parts including pumps, valves, controls, special piping and fittings, instruments, spray nozzles, and similar items.

Other capital costs include the following elements:

- Land required for the FGD process, waste disposal, regeneration facility, and storage.
- Working capital, including the total amount of money invested in raw materials and supplies in stock, finished products in stock, and unfinished products

in the process of being manufactured; accounts receivable; cash kept on hand for payment of operating expenses such as salaries, wages, and raw materials purchases; accounts payable; and taxes payable.

Annual cost of an FGD system includes the following direct, fixed and overhead charges:

- Direct Charges
  - Raw materials, including those required by the FGD process for sulfur dioxide control, absorbent regeneration, sludge treatment, sludge fixation, flocculants, etc.
  - Utilities, including water for slurries, cooling and cleaning; electricity for pumps, fans, valves, lighting controls, conveyors, and mixers; fuel for reheating of flue gases; and stream for processing.
  - Operating labor, including supervisory, skilled, and unskilled labor required to operate, monitor, and control the FGD process.
  - Maintenance and repairs, consisting of both manpower and materials to keep the unit operating efficiently. The function of maintenance is both preventive and corrective to keep outages to a minimum.
  - Byproduct Sales: credit from the sale of byproducts regenerable FGD processes (e.g. sulfur, sulfuric acid) is a negative charge deducted from the annual direct cost to obtain the net annual direct cost of the FGD system.
- Fixed Charges
  - Depreciation - the annual charge to recover direct and indirect costs of physical assets over the life of the asset.
  - Interim, replacement - costs expended for temporary or provisional replacement of equipment that has failed or malfunctioned prematurely.
  - Insurance, including the costs of protection from loss by a specified contingency, peril, or unforeseen event. Required coverage could include losses due to fire, personal injury or death, property damage, explosion, lightning, or other natural phenomena.

- Taxes, including franchise, excise, and property taxes levied by a city, county, state, or Federal government.
- Interest on borrowed funds.

° Overhead

Plant and administrative overhead is a business expense that is not charged directly to a particular part of a project, but is allocated to it. Overhead costs include administrative, safety, engineering, legal and medical services; payroll; employee benefits; recreation; and public relations.

Table A-2 provides a summary of the means used to determine the missing cost elements if the costs were not reported or insufficient information prevented their actual determination. The assumptions and cost bases for determining the capital and annual costs of FGD systems were developed by the PEDCo staff based upon previous economic studies conducted for the U.S. EPA (Flue Gas Desulfurization Process Cost Assessment, May 1975; Simplified Procedures for Estimating Flue Gas Desulfurization System Costs, June 1976, EPA-600/2-76-150; Particulate and Sulfur Dioxide Emission Control Costs for Large Coal-Fired Boilers, March 1978, EPA-600/7-78-032).

TABLE A-2. COST ELEMENT FACTORS

Category	Value
Indirect capital costs:	
Interest during construction	10% of total direct capital costs
Field overhead	10% of total direct capital costs
Contractor's fee and expenses	5% of total direct capital costs
Engineering	10% of total direct capital costs
Taxes	2% of total direct capital costs
Spares	1% of total direct capital costs
Shakedown allowance	5% of total direct capital costs
Other capital costs:	
Contingency[a]	20% of total direct and indirect capital costs
Direct annual costs:	
Raw materials:	
Fixation chemicals	\$2/ton
Lime	\$40/ton
Limestone	\$10/ton
Magnesium oxide	\$150/ton
Sodium carbonate	\$80/ton
Salt cake (credit)	\$50/ton
Sulfur (credit)	\$65/ton
Sulfuric acid (credit)	\$25/ton
Utilities:	
Electricity	25 mills/kWh
Water	\$0.20/10^3 gal
Steam	\$0.80/10^6 Btu
Operating labor:	
Direct labor	\$8.50/man-hour
Supervision	15% of direct labor costs

[a] Contingency costs are used only when the cost data supplied are incomplete (such as equipment costs or direct costs only) and a contingency cost must be factored in to give an accurate estimate of the total capital cost.

(continued)

TABLE A-2. (continued)

Category	Value
Maintenance:	
Labor and materials	4% of total direct capital costs
Supplies	15% of labor and materials costs
Overhead:	
Plant	50% of operation and maintenance costs
Payroll	20% of operating labor costs
Fixed annual costs:	
Depreciation	3.33% or 5% (new or retrofit)
Interim replacement[b]	0.7% or 0.35%
Taxes	4%
Insurance	0.3%
Capital costs	9%

[b] Some system components have life spans less than the expected service life of the system. Interim replacement is an allowance factor used in estimating annual revenue requirements to provide for the replacement of these short-lived items. An average allowance of 0.35% of the total investment is normally provided and used for systems with an expected service life of 20 years or less. A higher allowance of 0.70% of the total investment is provided and used for systems with an expected service life of 30 years or more.

DEFINITION OF COST ELEMENTS

The costs displayed in Appendix A are accompanied by a series of alphabetic characters summarizing data presented for each FGD system. These relate to the cost elements described earlier in this section and identify what has been included and excluded for reported and adjusted capital and annual costs. The alphabetic characters, along with their titles, are briefly described in Table A-3.

TABLE A-3. DESCRIPTION OF COST

Code	Title	Description
A	Particulate control (required for FGD process) included in capital cost.	Particulate precollection device (ESP, fabric filter, venturi) prior to FGD system required for proper operation of SO_2 control system.
B	Particulate control (included in FGD process) included in capital cost.	Particulate collection equipment (venturi scrubber) is included in the FGD system.
C	Total direct capital costs included.	Complete cost of all FGD equipment, the labor and materials required for equipment installation, and interconnecting the system is included in the total capital cost.
D	Partial direct capital costs included.	One or a number of direct cost items, or the cost associated with one or a number of direct cost items, are excluded from the total capital cost.
E	Total indirect capital costs included.	Complete cost of all the indirect cost elements, including interest during construction, contractor's fees, engineering, legal expenses, taxes, insurance, allowance for start-up, and spares, is included in total capital cost.
F	Partial indirect costs included.	One or a number of indirect cost items, or the cost associated with one or a number of indirect cost items, are excluded from the total capital cost.
G	Chemical fixation of sludge included in capital cost.	The cost of a chemical fixation process which stabilizes the flue gas cleaning wastes prior to disposal is included in the total capital cost.
H	Dry sludge disposal included in capital cost.	The cost of a secondary dewatering or treatment method, such as filtration, centrifugation, or forced oxidation, which ultimately produces a dry sludge cake for final disposal, is included in the total capital cost.
I	Off-site landfill area included in capital cost.	The cost of an off-site area used as a landfill for flue gas cleaning wastes is included in the total capital cost.
J	Sludge pond included in capital cost.	The cost of an on-site disposal area for ponding of treated or untreated flue gas cleaning wastes is included in the total capital cost.
K	Additional sludge disposal capacity added for life of system.	The cost of additional SO_2 waste disposal capacity required for FGD system operation over the anticipated service life of the unit is included in the total capital cost.
L	Stack included in capital cost.	The cost of the stack is included in the total capital cost.
M	Modifications to stack, ducts, and/or fans included in capital cost.	Modifications to existing equipment (stack, fans, ducts, etc.) which are required because of inclusion of an FGD system.
N	Total regeneration facility cost included in capital cost.	Complete cost of entire regeneration facility included in total capital cost.
O	Partial regeneration facility cost included in capital cost.	Part of the cost associated with the regeneration facility included in the total capital cost.
P	R & D costs included in capital cost.	Bench scale or pilot plant studies to determine process and design characteristics.

(continued)

TABLE A-3. (continued)

Code	Title	Description
Q	Costs underwritten by system supplier included in capital cost.	Capital expenditures underwritten by the system supplier for system repairs or modifications for optimization of performance or R & D programs.
R	Excess reagent supply costs included in capital cost.	Capital expenditures for reagent supply exceeds the amount required for the period of initial operation.
S	Total direct annual costs included.	Complete cost of all raw materials, utilities, operating labor and maintenance and repairs is included in the total annual cost.
T	Partial direct annual costs included.	One or a number of direct annual cost items, or the cost associated with one or a number of direct annual cost items, are excluded from the total annual cost.
U	Total fixed annual costs included.	Complete cost of all fixed cost elements, including depreciation, interim replacement, insurance, taxes, and interest, is included in the total annual cost.
V	Partial fixed annual costs included.	One or a number of fixed annual cost items, or the cost associated with one or a number of fixed annual cost items, are excluded from the total annual cost.
W	Overhead cost included in total annual cost.	Plant and payroll overhead costs are included in the total annual cost.
X	Particulate control costs included in direct annual cost.	The cost of operating particulate collection equipment included in the FGD system is included in the total annual cost.
Y	Sludge disposal service costs (contract) included in direct annual cost.	The treatment and disposal of flue gas cleaning wastes that are handled by an outside firm.
Z	Replacement energy costs included in total annual costs.	The cost of additional power-generating capacity required to compensate for power used by the FGD system.

RESULTS OF COST ANALYSIS

The results of the operational FGD system survey are summarized in Table A-4 and Section A-1. Table A-4 produces a summary of a categorical analysis of the reported and adjusted capital and annual costs for the operational FGD systems addressed in the survey. Included in this categorical analysis are the ranges, means, and standard deviation for all the various types and categories of FGD systems examined. Section A-1 summarizes the reported and adjusted capital and annual costs for all the operational FGD systems addressed in the survey (Section A-2 summarizes available cost data for nonoperational FGD systems).

In an attempt to further clarify and allow additional comparison of costs between different FGD units, the adjusted fixed annual costs were standardized. This was done by taking the adjusted Total Direct and Indirect Capital Costs for each unit and applying the identical rate for costs of depreciation, interim replacement, taxes, insurance and capital. These new sums were totaled, then added to the adjusted Variable Cost to determine the Total Standardized Annual Costs. In this manner costs can be compared based upon the assumption that Utilities can incur Fixed Annual Costs at the same rate.

TABLE A-4. CATEGORICAL RESULTS OF THE REPORTED AND ADJUSTED CAPITAL AND ANNUAL COSTS FOR OPERATIONAL FGD SYSTEMS

CATEGORY	REPORTED						ADJUSTED					
	CAPITAL, $/KW			ANNUAL, MILLS/KWH			CAPITAL, $/KW			ANNUAL, MILLS/KWH		
	RANGE	AVG	DEV	RANGE	AVG	DEV	RANGE	AVG	DEV	RANGE	AVG	DEV
ALL	5.3-156.9	77.0	36.9	.3- 14.9	6.3	5.1	60.9-233.2	94.2	35.2	2.7- 12.4	5.5	2.4
NEW	5.3-120.6	71.4	30.0	.3- 14.3	4.6	5.0	66.4-117.6	85.5	16.9	2.8- 8.7	5.2	2.0
RETROFIT	29.2-156.9	83.7	42.7	2.1- 14.9	8.3	4.4	60.9-233.2	103.6	45.8	2.7- 12.4	5.8	2.6
THROWAWAY PRODUCT	5.3-120.6	67.1	29.2	.3- 14.3	5.9	4.9	60.9-140.6	87.0	21.2	2.7- 8.7	5.2	1.9
SALEABLE PRODUCT	93.3-156.9	132.5	23.5	3.3- 14.9	9.1	5.8	134.8-233.2	184.0	49.2	12.4- 12.4	12.4	.0
LIMESTONE	5.3- 99.5	61.4	27.6	1.6- 3.3	2.2	.8	66.4-117.6	93.1	21.9	2.9- 6.6	5.0	1.4
LIME	29.2-120.6	74.1	29.7	.3- 14.3	9.0	4.5	67.5-140.6	88.9	21.1	2.7- 8.7	6.0	2.0
LIME/ALKALINE FLYASH	85.9- 85.9	85.9	.0	*****- .0	.0	.0	93.0- 93.0	93.0	.0	5.2- 5.2	5.2	.0
SODIUM CARBONATE	42.9-113.6	66.5	33.3	2.1- 2.1	2.1	.0	60.9-107.9	76.6	22.2	3.2- 4.4	3.6	.6
WELLMAN LORD	127.9-156.9	137.6	13.7	14.9- 14.9	14.9	.0	134.8-134.8	134.8	.0	12.4- 12.4	12.4	.0
LIMESTONE/ALKALINE FLYASH	47.9- 47.9	47.9	.0	2.0- 2.0	2.0	.0	71.5- 71.5	71.5	.0	2.8- 2.8	2.8	.0
MAGNESIUM OXIDE	156.7-156.7	156.7	.0	*****- .0	.0	.0	233.2-233.2	233.2	.0	*****- .0	.0	.0

SECTION A-1
COSTS FOR OPERATIONAL FGD SYSTEMS

UNIT DESCRIPTION	COST DESCRIPTION	COST REPORTED	 ADJUSTED	 STANDARDIZED ADJUSTED
ALABAMA ELECTRIC COOP	CAPACITY FACTOR, %	0	65	65
TOMBIGBEE	TOTAL CAPITAL, $/KW(YEAR)	69.5(1978)	.0(0)	.0(0)
2	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	.0(0)	.0(0)
179.0 MW (NET)	COST ELEMENTS	C,E,J		
ARIZONA ELECTRIC POWER COOP	CAPACITY FACTOR, %	0	65	65
APACHE	TOTAL CAPITAL, $/KW(YEAR)	5.3(1978)	.0(0)	.0(0)
2	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	.0(0)	.0(0)
180.0 MW (NET)	COST ELEMENTS	B,C		
CENTRAL ILLINOIS LIGHT	CAPACITY FACTOR, %	0	65	65
DUCK CREEK	TOTAL CAPITAL, $/KW(YEAR)	93.3(1978)	.0(0)	.0(0)
1	TOTAL ANNUAL, MILLS/KWH(YEAR)	3.3(0)	.0(0)	.0(0)
416.0 MW (NET)	COST ELEMENTS	C,E,J,M		
COLUMBUS & SOUTHERN OHIO ELEC.	CAPACITY FACTOR, %	51	65	65
CONESVILLE	TOTAL CAPITAL, $/KW(YEAR)	55.5(1975)	70.7(1975)	70.7(1975)
5	TOTAL ANNUAL, MILLS/KWH(YEAR)	4.7(0)	7.4(0)	7.4(0)
411.0 MW (NET)	COST ELEMENTS	B,C,J,M,T,X,Y	C,E,J,M,S,U,W,Y	C,F,J,M,S,U,W,Y
COLUMBUS & SOUTHERN OHIO ELEC.	CAPACITY FACTOR, %	0	65	65
CONESVILLE	TOTAL CAPITAL, $/KW(YEAR)	55.5(1978)	70.7(1978)	.0(0)
6	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	.0(0)	.0(0)
411.0 MW (NET)	COST ELEMENTS	B,C,J,M,T,X,Y	C,E,J,M,S,U,W,Y	
DUQUESNE LIGHT	CAPACITY FACTOR, %	64	65	65
ELRAMA	TOTAL CAPITAL, $/KW(YEAR)	113.4(1976)	127.1(0)	127.1(1976)
1-4	TOTAL ANNUAL, MILLS/KWH(YEAR)	8.6(0)	7.8(0)	7.5(0)
510.0 MW (NET)	COST ELEMENTS	B,D,F,I,J,M,T,V,X,Y	C,E,I,J,M,S,U,Y	C,E,I,J,M,S,U,Y
DUQUESNE LIGHT	CAPACITY FACTOR, %	70	65	65
PHILLIPS	TOTAL CAPITAL, $/KW(YEAR)	106.9(1972)	140.6(1972)	140.6(1972)
1-6	TOTAL ANNUAL, MILLS/KWH(YEAR)	7.8(0)	8.6(0)	8.2(0)
410.0 MW (NET)	COST ELEMENTS	B,D,F,I,J,M,T,V,X,Y	C,E,I,J,M,S,U,Y	C,E,I,J,M,S,U,Y
INDIANAPOLIS POWER & LIGHT	CAPACITY FACTOR, %	0	65	65
PETERSBURG	TOTAL CAPITAL, $/KW(YEAR)	99.5(1976)	100.6(1976)	100.6(1976)
3	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	6.6(0)	7.4(0)
532.0 MW (NET)	COST ELEMENTS	C,F,G,J,M	C,E,G,J,M,S,U,W,Y	C,F,G,J,M,S,U,W,Y
KANSAS CITY POWER & LIGHT	CAPACITY FACTOR, %	14	65	65
HAWTHORN	TOTAL CAPITAL, $/KW(YEAR)	29.2(1972)	87.2(1972)	87.2(1972)
3	TOTAL ANNUAL, MILLS/KWH(YEAR)	8.4(0)	4.3(0)	4.4(0)
110.0 MW (NET)	COST ELEMENTS	B,D,F,T,X	B,C,E,J,K,S,U,W,X	B,C,E,J,K,S,U,W,X
KANSAS CITY POWER & LIGHT	CAPACITY FACTOR, %	0	65	65
HAWTHORN	TOTAL CAPITAL, $/KW(YEAR)	29.2(1972)	87.2(1972)	87.2(1972)
4	TOTAL ANNUAL, MILLS/KWH(YEAR)	8.4(0)	4.3(0)	4.4(0)
110.0 MW (NET)	COST ELEMENTS	B,D,F,T,X	B,C,E,J,K,S,U,W,X	B,C,E,J,K,S,U,W,X

****** INDICATES COST FIGURES NOT YET AVAILABLE

SECTION A-1
COSTS FOR OPERATIONAL FGD SYSTEMS

UNIT DESCRIPTION	COST DESCRIPTION	COST REPORTED	 ADJUSTED	 STANDARDIZED ADJUSTED
KANSAS CITY POWER & LIGHT	CAPACITY FACTOR, %	30	65	65
LA CYGNE	TOTAL CAPITAL, $/KW(YEAR)	53.6(1972)	68.0(1972)	68.0(1972)
1	TOTAL ANNUAL, MILLS/KWH(YEAR)	1.7(0)	3.8(0)	3.9(0)
874.0 MW (NET)	COST ELEMENTS	B,C,E,J,S	C,E,J,K,S,U	C,E,J,K,S,U
KENTUCKY UTILITIES	CAPACITY FACTOR, %	16	65	65
GREEN RIVER	TOTAL CAPITAL, $/KW(YEAR)	70.3(1975)	77.5(1975)	77.5(1975)
1-3	TOTAL ANNUAL, MILLS/KWH(YEAR)	14.3(0)	2.7(0)	5.2(0)
64.0 MW (NET)	COST ELEMENTS	B,C,E,J,S,U, W	C,E,J,S,U,W	C,E,J,S,U,W
LOUISVILLE GAS & ELECTRIC	CAPACITY FACTOR, %	55	65	65
CANE RUN	TOTAL CAPITAL, $/KW(YEAR)	66.5(1975)	80.6(1975)	80.6(1975)
4	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	5.8(0)	6.2(0)
190.0 MW (NET)	COST ELEMENTS	C,E,H,J,Q,T	C,E,H,J,K,Q, S,U,W	C,E,H,J,K,Q, S,U,W
LOUISVILLE GAS & ELECTRIC	CAPACITY FACTOR, %	0	65	65
CANE RUN	TOTAL CAPITAL, $/KW(YEAR)	62.4(1977)	67.5(1977)	67.5(1977)
5	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	5.6(0)	5.6(0)
200.0 MW (NET)	COST ELEMENTS	C,E,H,J	C,E,H,J,K,S, U,W	C,E,H,J,K,S, U,W
LOUISVILLE GAS & ELECTRIC	CAPACITY FACTOR, %	0	65	65
PADDY'S RUN	TOTAL CAPITAL, $/KW(YEAR)	52.8(1973)	76.4(1973)	76.4(1973)
6	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	6.5(0)	6.4(0)
70.0 MW (NET)	COST ELEMENTS	C,E	C,E,S,U,W	C,E,S,U,W
MINNKOTA POWER COOPERATIVE	CAPACITY FACTOR, %	0	65	65
MILTON R. YOUNG	TOTAL CAPITAL, $/KW(YEAR)	85.9(1976)	93.0(1976)	93.0(0)
2	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	5.2(0)	5.2(0)
405.0 MW (NET)	COST ELEMENTS	C,E,H,P	C,E,H,N,P,S, U,W	C,E,H,N,P,S, U,W
MONTANA POWER	CAPACITY FACTOR, %	76	65	65
COLSTRIP	TOTAL CAPITAL, $/KW(YEAR)	77.1(1975)	77.2(1975)	77.2(1975)
1	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	4.1(0)	4.0(0)
360.0 MW (NET)	COST ELEMENTS	B,C,E,J,P,T	C,E,J,K,P,S, U,W	C,E,J,K,P,S, U,W
MONTANA POWER	CAPACITY FACTOR, %	76	65	65
COLSTRIP	TOTAL CAPITAL, $/KW(YEAR)	77.1(1975)	77.2(1975)	77.2(1975)
2	TOTAL ANNUAL, MILLS/KWH(YEAR)	.3(0)	4.1(0)	4.1(0)
360.0 MW (NET)	COST ELEMENTS	B,C,E,J,P,T	C,E,J,K,P,S, U,W	C,E,J,K,P,S, U,W
NEVADA POWER	CAPACITY FACTOR, %	67	65	65
REID GARDNER	TOTAL CAPITAL, $/KW(YEAR)	42.9(1973)	60.9(1973)	60.9(1973)
1	TOTAL ANNUAL, MILLS/KWH(YEAR)	2.1(0)	3.2(0)	3.4(0)
125.0 MW (NET)	COST ELEMENTS	B,D,E,P,S,U, W,X	B,D,E,P,S,U, W,X	B,D,E,P,S,U, W,X
NEVADA POWER	CAPACITY FACTOR, %	67	65	65
REID GARDNER	TOTAL CAPITAL, $/KW(YEAR)	42.9(1973)	60.9(1973)	60.9(1973)
2	TOTAL ANNUAL, MILLS/KWH(YEAR)	2.1(0)	3.2(0)	3.4(0)
125.0 MW (NET)	COST ELEMENTS	B,D,E,P,S,U, W,X	B,D,E,P,S,U, W,X	B,D,E,P,S,U, W,X

****** INDICATES COST FIGURES NOT YET AVAILABLE

SECTION A-1
COSTS FOR OPERATIONAL FGD SYSTEMS

UNIT DESCRIPTION	COST DESCRIPTION	COST REPORTED	COST ADJUSTED	COST STANDARDIZED ADJUSTED
NEVADA POWER	CAPACITY FACTOR, %	67	65	65
REID GARDNER	TOTAL CAPITAL, $/KW(YEAR)	113.6(1975)	107.9(1975)	107.9(1975)
3	TOTAL ANNUAL, MILLS/KWH(YEAR)	2.1(0)	4.4(0)	5.0(0)
125.0 MW (NET)	COST ELEMENTS	B,C,E,L,S,U,W,X	B,C,E,L,S,U,W,X	B,C,E,L,S,U,W,X
NORTHERN INDIANA PUB SERVICE	CAPACITY FACTOR, %	77	65	65
DEAN H. MITCHELL	TOTAL CAPITAL, $/KW(YEAR)	156.9(1976)	134.8(1976)	134.8(1976)
11	TOTAL ANNUAL, MILLS/KWH(YEAR)	14.9(0)	12.4(0)	11.0(0)
115.0 MW (NET)	COST ELEMENTS	B,C,E,L,N,S,U,W,X,Z	C,E,L,N,S,U,W,Z	C,E,L,N,S,U,W,Z
NORTHERN STATES POWER	CAPACITY FACTOR, %	73	65	65
SHERBURNE	TOTAL CAPITAL, $/KW(YEAR)	47.9(1972)	71.5(1972)	71.5(1972)
1	TOTAL ANNUAL, MILLS/KWH(YEAR)	2.0(0)	2.8(0)	3.3(0)
720.0 MW (NET)	COST ELEMENTS	B,C,J,S,U,X,Z	C,E,J,K,S,U,W	C,E,J,K,S,U,W
NORTHERN STATES POWER	CAPACITY FACTOR, %	73	65	65
SHERBURNE	TOTAL CAPITAL, $/KW(YEAR)	47.9(1972)	71.5(1972)	71.5(1972)
2	TOTAL ANNUAL, MILLS/KWH(YEAR)	2.0(0)	2.8(0)	3.3(0)
720.0 MW (NET)	COST ELEMENTS	B,C,J,S,U,X,Z	C,E,J,K,S,U,W	C,E,J,K,S,U,W
PENNSYLVANIA POWER	CAPACITY FACTOR, %	40	65	65
BRUCE MANSFIELD	TOTAL CAPITAL, $/KW(YEAR)	120.6(1975)	102.1(1975)	102.1(1975)
1	TOTAL ANNUAL, MILLS/KWH(YEAR)	14.3(0)	8.7(0)	10.8(0)
917.0 MW (NET)	COST ELEMENTS	B,C,E,G,I,L,S,U,W,X	C,E,G,I,M,S,U,W	C,E,G,I,M,S,U,W
PENNSYLVANIA POWER	CAPACITY FACTOR, %	40	65	65
BRUCE MANSFIELD	TOTAL CAPITAL, $/KW(YEAR)	120.6(1975)	102.1(1975)	102.1(1975)
2	TOTAL ANNUAL, MILLS/KWH(YEAR)	14.3(0)	8.7(0)	10.8(0)
917.0 MW (NET)	COST ELEMENTS	B,C,E,G,I,L,S,U,W,X	C,E,G,I,M,S,U,W	C,E,G,I,M,S,U,W
PHILADELPHIA ELECTRIC	CAPACITY FACTOR, %	0	65	65
~~EDDYS~~TONE	TOTAL CAPITAL, $/KW(YEAR)	156.7(1972)	233.2(1972)	.0(0)
1A	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	.0(0)	.0(0)
120.0 MW (NET)	COST ELEMENTS	D,F,N,P	C,E,N,P	
PUBLIC SERVICE OF NEW MEXICO	CAPACITY FACTOR, %	0	65	65
SAN JUAN	TOTAL CAPITAL, $/KW(YEAR)	127.9(1977)	.0(0)	.0(0)
1	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	.0(0)	.0(0)
361.0 MW (NET)	COST ELEMENTS	A,C,E,N		
PUBLIC SERVICE OF NEW MEXICO	CAPACITY FACTOR, %	0	65	65
SAN JUAN	TOTAL CAPITAL, $/KW(YEAR)	127.9(1977)	.0(0)	.0(0)
2	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	.0(0)	.0(0)
350.0 MW (NET)	COST ELEMENTS	A,C,E,N		
SOUTH CAROLINA PUBLIC SERVICE	CAPACITY FACTOR, %	80	65	65
WINYAH	TOTAL CAPITAL, $/KW(YEAR)	47.4(1976)	66.4(1976)	6.4(1976)
2	TOTAL ANNUAL, MILLS/KWH(YEAR)	1.6(0)	2.9(0)	3.2(0)
140.0 MW (NET)	COST ELEMENTS	C,F,J,M,S,V	C,E,J,K,M,S,U,W	C,E,J,K,M,S,U,W

****** INDICATES COST FIGURES NOT YET AVAILABLE

SECTION A-1
COSTS FOR OPERATIONAL FGD SYSTEMS

UNIT DESCRIPTION	COST DESCRIPTION	COST		
		REPORTED	ADJUSTED	STANDARDIZED ADJUSTED
SOUTHERN MISSISSIPPI ELECTRIC	CAPACITY FACTOR, %	0	65	65
R.D. MORROW	TOTAL CAPITAL, $/KW(YEAR)	37.4(1975)	.0(0)	.0(0)
1	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	.0(0)	.0(0)
124.0 MW (NET)	COST ELEMENTS	C,E		
SPRINGFIELD CITY UTILITIES	CAPACITY FACTOR, %	0	65	65
SOUTHWEST	TOTAL CAPITAL, $/KW(YEAR)	77.3(1974)	117.6(1974)	117.6(1974)
1	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	6.2(0)	6.9(0)
194.0 MW (NET)	COST ELEMENTS	C,F,H,J,P	C,E,H,J,K,P,S,U,W	C,E,H,J,K,P,S,U,W
TENNESSEE VALLEY AUTHORITY	CAPACITY FACTOR, %	0	65	65
WIDOWS CREEK	TOTAL CAPITAL, $/KW(YEAR)	69.5(1978)	113.1(1976)	113.1(1976)
8	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	5.3(0)	5.1(0)
550.0 MW (NET)	COST ELEMENTS	C,E,J	C,E,J,S,U,W	C,F,J,S,U,W

****** INDICATES COST FIGURES NOT YET AVAILABLE

SECTION A-2
COSTS FOR NON-OPERATIONAL FGD SYSTEMS

UNIT DESCRIPTION	COST DESCRIPTION	COST REPORTED	COST ADJUSTED	COST STANDARDIZED ADJUSTED
ALABAMA ELECTRIC COOP	CAPACITY FACTOR, %	0	65	65
TOMBIGBEE	TOTAL CAPITAL, $/KW(YEAR)	69.5(1978)	.0(0)	.0(0)
3	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	.0(0)	.0(0)
179.0 MW (NET)	COST ELEMENTS	C,E,J		
ARIZONA ELECTRIC POWER COOP	CAPACITY FACTOR, %	0	65	65
APACHE	TOTAL CAPITAL, $/KW(YEAR)	5.3(1978)	.0(0)	.0(0)
3	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	.0(0)	.0(0)
180.0 MW (NET)	COST ELEMENTS	B,C		
BASIN ELECTRIC POWER COOP	CAPACITY FACTOR, %	0	65	65
LARAMIE RIVER	TOTAL CAPITAL, $/KW(YEAR)	68.2(1980)	.0(0)	.0(0)
1	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	.0(0)	.0(0)
600.0 MW (NET)	COST ELEMENTS	C,E		
BASIN ELECTRIC POWER COOP	CAPACITY FACTOR, %	0	65	65
LARAMIE RIVER	TOTAL CAPITAL, $/KW(YEAR)	68.2(1980)	.0(0)	.0(0)
2	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	.0(0)	.0(0)
600.0 MW (NET)	COST ELEMENTS	C,E		
BIG RIVERS ELECTRIC	CAPACITY FACTOR, %	0	65	65
GREEN	TOTAL CAPITAL, $/KW(YEAR)	43.2(1976)	.0(0)	.0(0)
1	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	.0(0)	.0(0)
242.0 MW (NET)	COST ELEMENTS	B,C		
BOSTON EDISON	CAPACITY FACTOR, %	0	65	65
MYSTIC	TOTAL CAPITAL, $/KW(YEAR)	63.4(1972)	.0(0)	.0(0)
6	TOTAL ANNUAL, MILLS/KWH(YEAR)	3.0(0)	.0(0)	.0(0)
.0 MW (NET)	COST ELEMENTS	B,C,E,H,Q		
CENTRAL ILLINOIS PUBLIC SERV	CAPACITY FACTOR, %	0	65	65
NEWTON	TOTAL CAPITAL, $/KW(YEAR)	189.0(1979)	.0(0)	.0(0)
1	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	.0(0)	.0(0)
617.0 MW (NET)	COST ELEMENTS	C,E,G		
COLORADO UTE ELECTRIC ASSN.	CAPACITY FACTOR, %	0	65	65
CRAIG	TOTAL CAPITAL, $/KW(YEAR)	117.0(1979)	.0(0)	.0(0)
1	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	.0(0)	.0(0)
450.0 MW (NET)	COST ELEMENTS	B,D,E		
COLORADO UTE ELECTRIC ASSN.	CAPACITY FACTOR, %	0	65	65
CRAIG	TOTAL CAPITAL, $/KW(YEAR)	117.0(1979)	.0(0)	.0(0)
2	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	.0(0)	.0(0)
450.0 MW (NET)	COST ELEMENTS	A,C		
COMMONWEALTH EDISON	CAPACITY FACTOR, %	0	65	65
POWERTON	TOTAL CAPITAL, $/KW(YEAR)	117.7(1979)	.0(0)	.0(0)
51	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	.0(0)	.0(0)
425.0 MW (NET)	COST ELEMENTS	C,E,H,J		

****** INDICATES COST FIGURES NOT YET AVAILABLE

SECTION A-2
COSTS FOR NON-OPERATIONAL FGD SYSTEMS

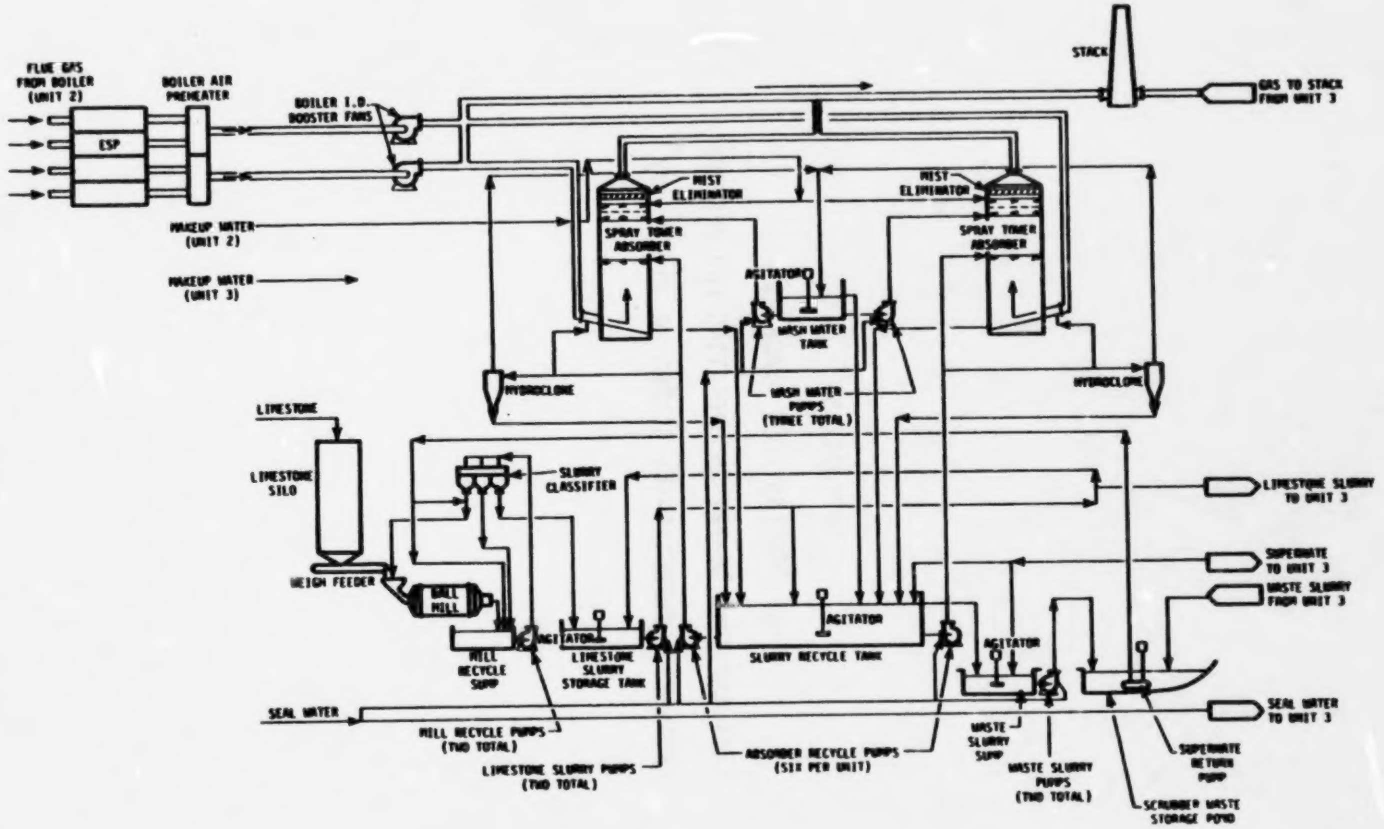
		COST		
UNIT DESCRIPTION	COST DESCRIPTION	REPORTED	ADJUSTED	STANDARDIZED ADJUSTED
COMMONWEALTH EDISON	CAPACITY FACTOR, %	49	65	65
WILL COUNTY	TOTAL CAPITAL, $/KW(YEAR)	113.0(1972)	.0(0)	.0(0)
1	TOTAL ANNUAL, MILLS/KWH(YEAR)	13.1(0)	.0(0)	.0(0)
.0 MW (NET)	COST ELEMENTS	B,C,E,G,J,X		
DETROIT EDISON	CAPACITY FACTOR, %	0	65	65
ST. CLAIR	TOTAL CAPITAL, $/KW(YEAR)	80.3(1976)	.0(0)	.0(0)
6	TOTAL ANNUAL, MILLS/KWH(YEAR)	9.6(0)	.0(0)	.0(0)
.0 MW (NET)	COST ELEMENTS	B,C,E,J,M,X		
ILLINOIS POWER COMPANY	CAPACITY FACTOR, %	0	65	65
WOOD RIVER	TOTAL CAPITAL, $/KW(YEAR)	82.5(1972)	.0(0)	.0(0)
4	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	.0(0)	.0(0)
.0 MW (NET)	COST ELEMENTS	A,C,E,M,N		
LOUISVILLE GAS & ELECTRIC	CAPACITY FACTOR, %	0	65	65
CANE RUN	TOTAL CAPITAL, $/KW(YEAR)	57.9(1977)	.0(0)	.0(0)
6	TOTAL ANNUAL, MILLS/KWH(YEAR)	3.2(0)	.0(0)	.0(0)
278.0 MW (NET)	COST ELEMENTS	C,E,H,M,S,V, W		
PACIFIC POWER & LIGHT	CAPACITY FACTOR, %	0	65	65
JIM BRIDGER	TOTAL CAPITAL, $/KW(YEAR)	120.0(1979)	.0(0)	.0(0)
4	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	.0(0)	.0(0)
550.0 MW (NET)	COST ELEMENTS	C,E,J		
POTOMAC ELECTRIC POWER	CAPACITY FACTOR, %	0	65	65
DICKERSON	TOTAL CAPITAL, $/KW(YEAR)	68.0(1978)	.0(0)	.0(0)
3	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	.0(0)	.0(0)
.0 MW (NET)	COST ELEMENTS	A,C,E,M		
PUBLIC SERVICE OF COLORADO	CAPACITY FACTOR, %	0	65	65
~~VALMONT~~	TOTAL CAPITAL, $/KW(YEAR)	87.0(1974)	.0(0)	.0(0)
5	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	.0(0)	.0(0)
.0 MW (NET)	COST ELEMENTS	B,C,E,J		
SALT RIVER PROJECT	CAPACITY FACTOR, %	0	65	65
CORONADO	TOTAL CAPITAL, $/KW(YEAR)	98.0(1978)	.0(0)	.0(0)
2	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	.0(0)	.0(0)
280.0 MW (NET)	COST ELEMENTS	C,E		
SOUTHERN INDIANA GAS & ELEC	CAPACITY FACTOR, %	0	65	65
A.B. BROWN	TOTAL CAPITAL, $/KW(YEAR)	43.2(1979)	.0(0)	.0(0)
1	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	.0(0)	.0(0)
265.0 MW (NET)	COST ELEMENTS	C,E,G		
SOUTHERN MISSISSIPPI ELECTRIC	CAPACITY FACTOR, %	0	65	65
R.D. MORROW	TOTAL CAPITAL, $/KW(YEAR)	37.4(1975)	.0(0)	.0(0)
2	TOTAL ANNUAL, MILLS/KWH(YEAR)	.0(0)	.0(0)	.0(0)
124.0 MW (NET)	COST ELEMENTS	C,E		

****** INDICATES COST FIGURES NOT YET AVAILABLE

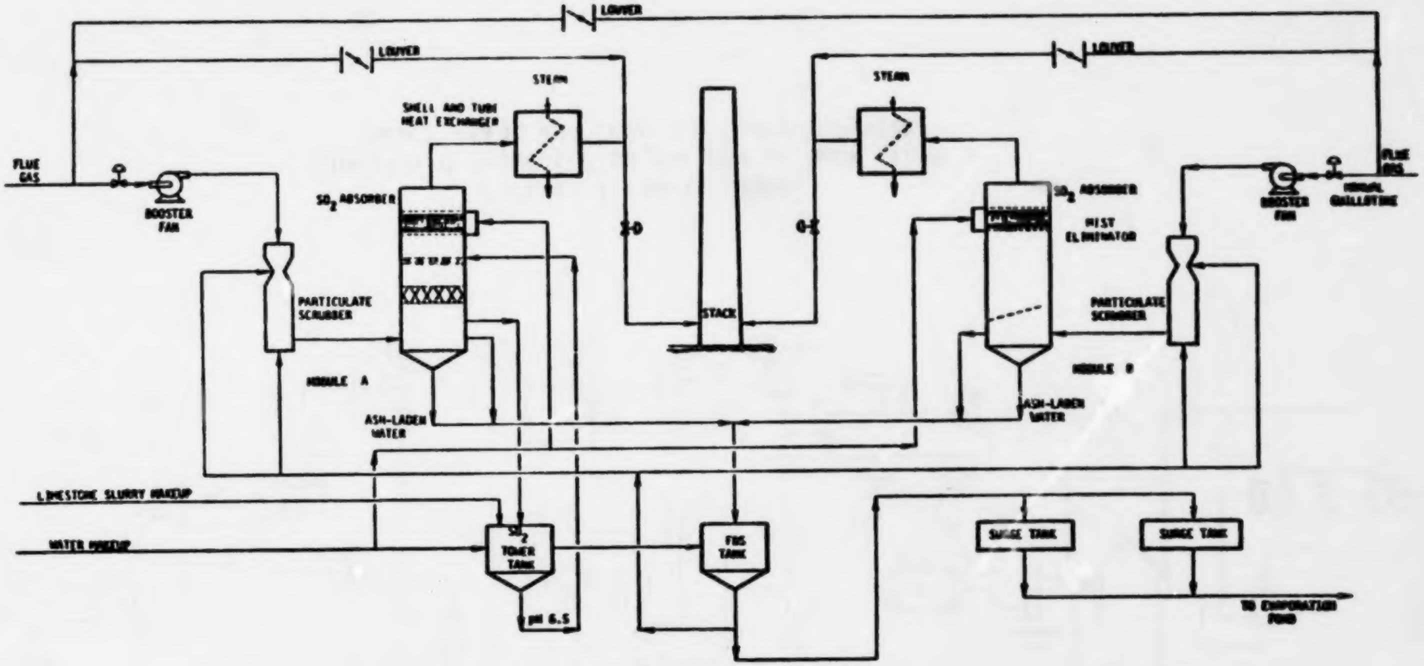
APPENDIX B

FGD PROCESS FLOW DIAGRAMS

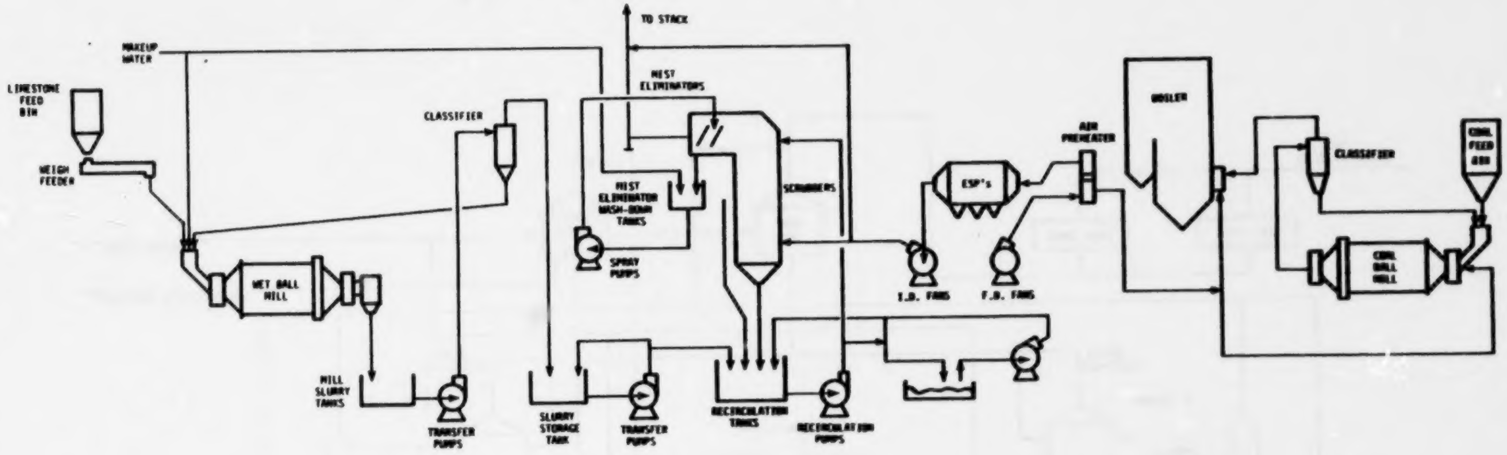
THIS APPENDIX COMPRISES OPERATING FGD SYSTEMS
ARRANGED ALPHABETICALLY ACCORDING TO UTILITY


FLUE GAS FROM BOILER (UNIT 2)
ESP
BOILER AIR PREHEATER
BOILER I.D. BOOSTER FANS
STACK
GAS TO STACK FROM UNIT 3
MAKEUP WATER (UNIT 2)
MAKEUP WATER (UNIT 3)
MIST ELIMINATOR
SPRAY TOWER ABSORBER
MIST ELIMINATOR
SPRAY TOWER ABSORBER
AGITATOR
WASH WATER TANK
WASH WATER PUMPS (THREE TOTAL)
HYDROCLONE
HYDROCLONE
LIMESTONE
LIMESTONE SILO
SLURRY CLASSIFIER
LIMESTONE SLURRY TO UNIT 3
WEIGH FEEDER
BALL MILL
MILL RECYCLE SUMP
AGITATOR
LIMESTONE SLURRY STORAGE TANK
AGITATOR
SLURRY RECYCLE TANK
SUPERNATE TO UNIT 3
WASTE SLURRY FROM UNIT 3
AGITATOR
SEAL WATER
SEAL WATER TO UNIT 3
MILL RECYCLE PUMPS (TWO TOTAL)
LIMESTONE SLURRY PUMPS (TWO TOTAL)
ABSORBER RECYCLE PUMPS (SIX PER UNIT)
WASTE SLURRY SUMP
WASTE SLURRY PUMPS (TWO TOTAL)
SUPERNATE RETURN PUMP
SCRUBBER WASTE STORAGE POND

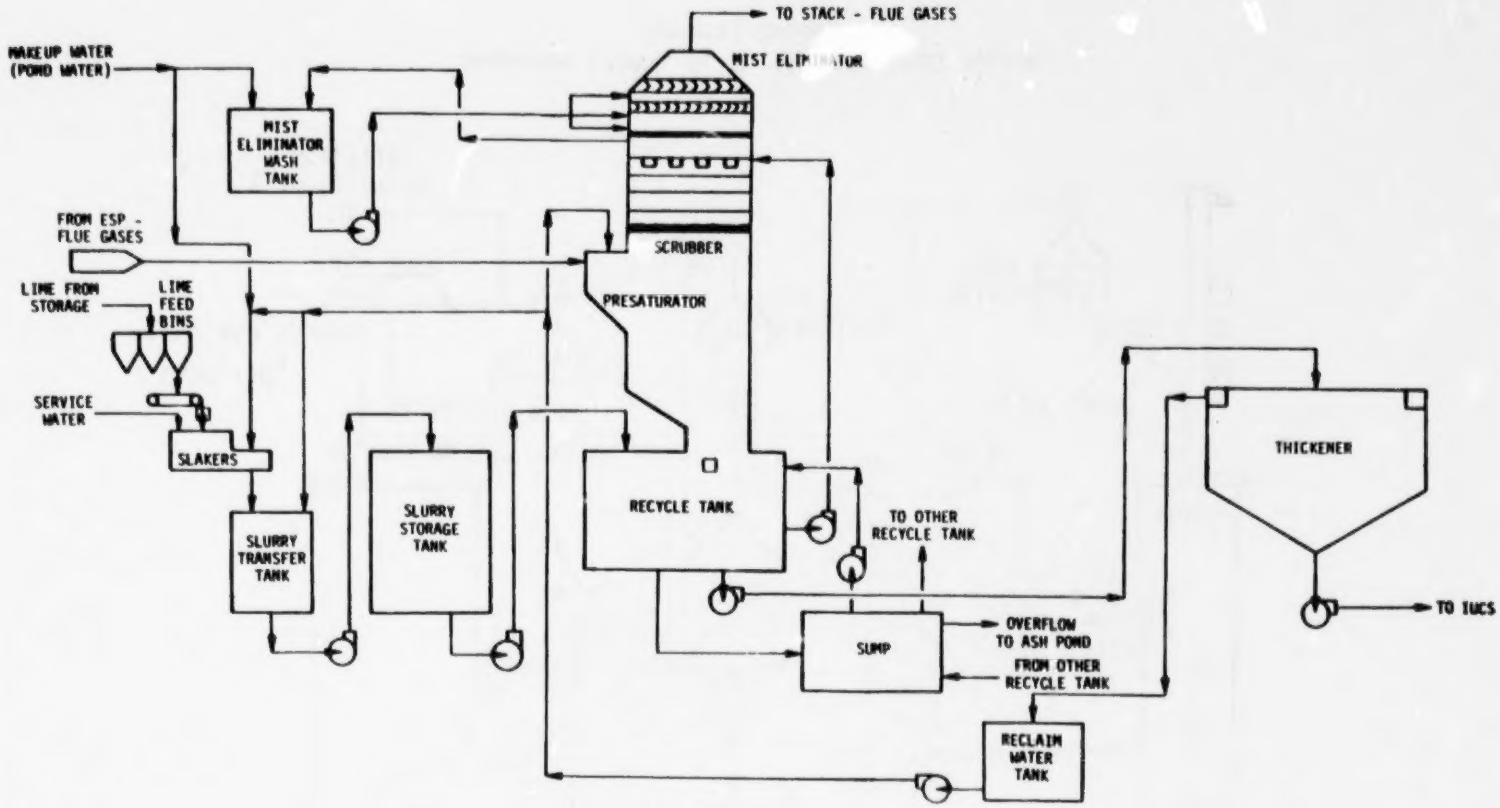
Alabama Electric,
Simplified Process Flow Diagram for Tombigbee 2


LOUVER
LOUVER
LOUVER
FLUE GAS
BOOSTER FAN
PARTICULATE SCRUBBER
SO_2 ABSORBER
SHELL AND TUBE HEAT EXCHANGER
STEAM
MODULE A
ASH-LADEN WATER
STACK
STEAM
SO_2 ABSORBER
MIST ELIMINATOR
PARTICULATE SCRUBBER
MODULE B
ASH-LADEN WATER
BOOSTER FAN
MANUAL GUILLOTINE
FLUE GAS
LIMESTONE SLURRY MAKEUP
WATER MAKEUP
SO_2 TOWER TANK
pH 6.5
FBS TANK
SURGE TANK
SURGE TANK
TO EVAPORATION POND

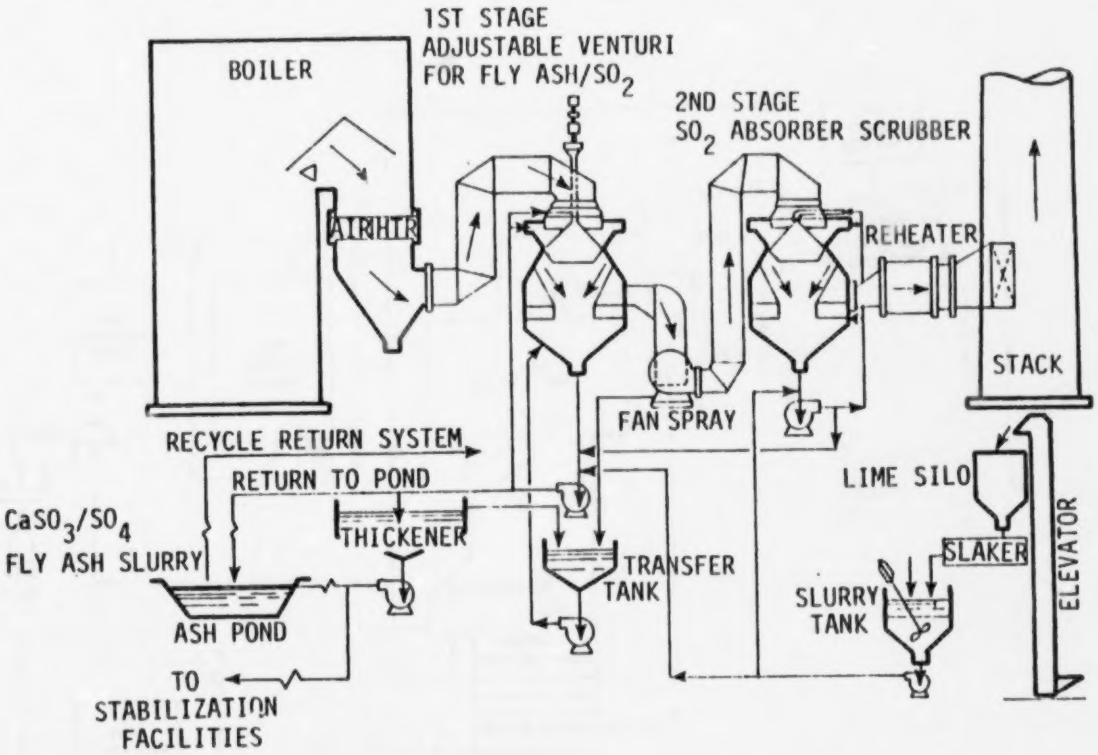
Arizona Public Service, Cholla 1:
Simplified Process Flow Diagram


TO STACK
MAKEUP WATER
LIMESTONE FEED BIN
WEIGH FEEDER
WET BALL MILL
MILL SLURRY TANKS
TRANSFER PUMPS
CLASSIFIER
SLURRY STORAGE TANK
TRANSFER PUMPS
MIST ELIMINATORS
MIST ELIMINATOR WASH-DOWN TANKS
SPRAY PUMPS
SCRUBBERS
RECIRCULATION TANKS
RECIRCULATION PUMPS
ESP's
I.D. FANS
F.D. FANS
AIR PREHEATER
BOILER
CLASSIFIER
COAL FEED BIN
COAL BALL MILL

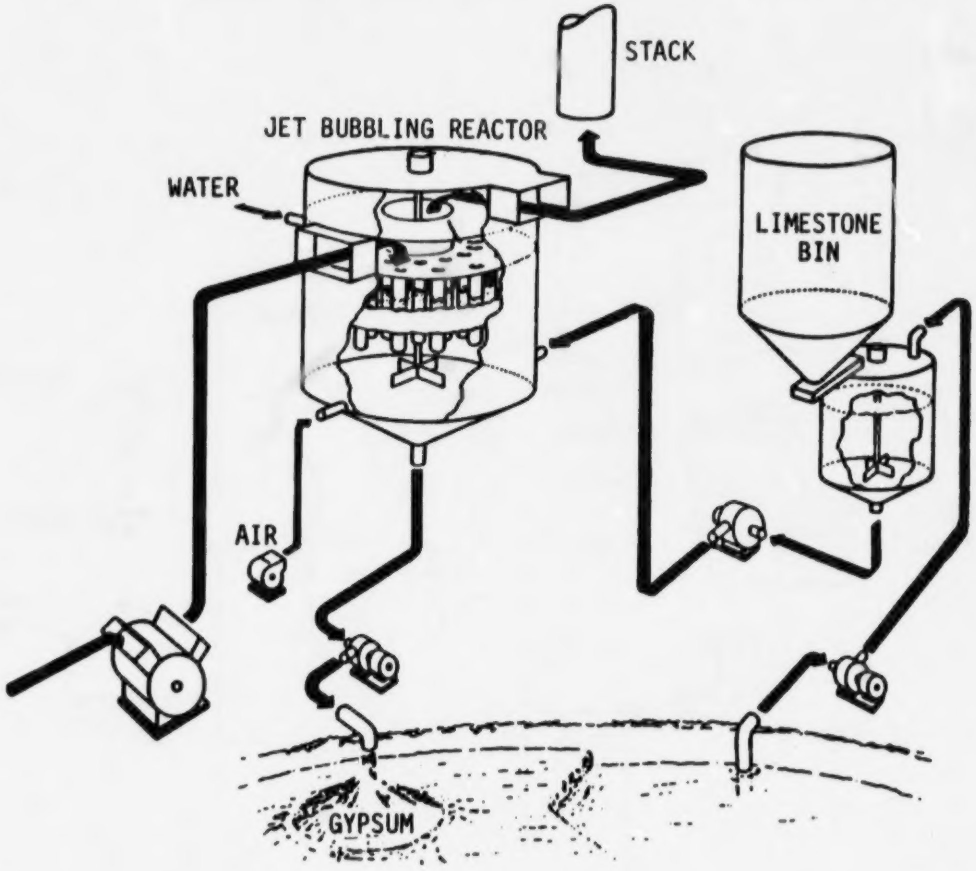
Central Illinois Light,
Simplified Process Flow Diagram of Duck Creek 1
Power Plant and Emission Control System


TO STACK - FLUE GASES
MIST ELIMINATOR
MAKEUP WATER (POND WATER)
MIST ELIMINATOR WASH TANK
FROM ESP - FLUE GASES
SCRUBBER
PRESATURATOR
LINE FROM STORAGE
LIME FEED BINS
SERVICE WATER
SLAKERS
SLURRY TRANSFER TANK
SLURRY STORAGE TANK
RECYCLE TANK
TO OTHER RECYCLE TANK
THICKENER
TO IUCS
SUMP
OVERFLOW TO ASH POND
FROM OTHER RECYCLE TANK
RECLAIM WATER TANK

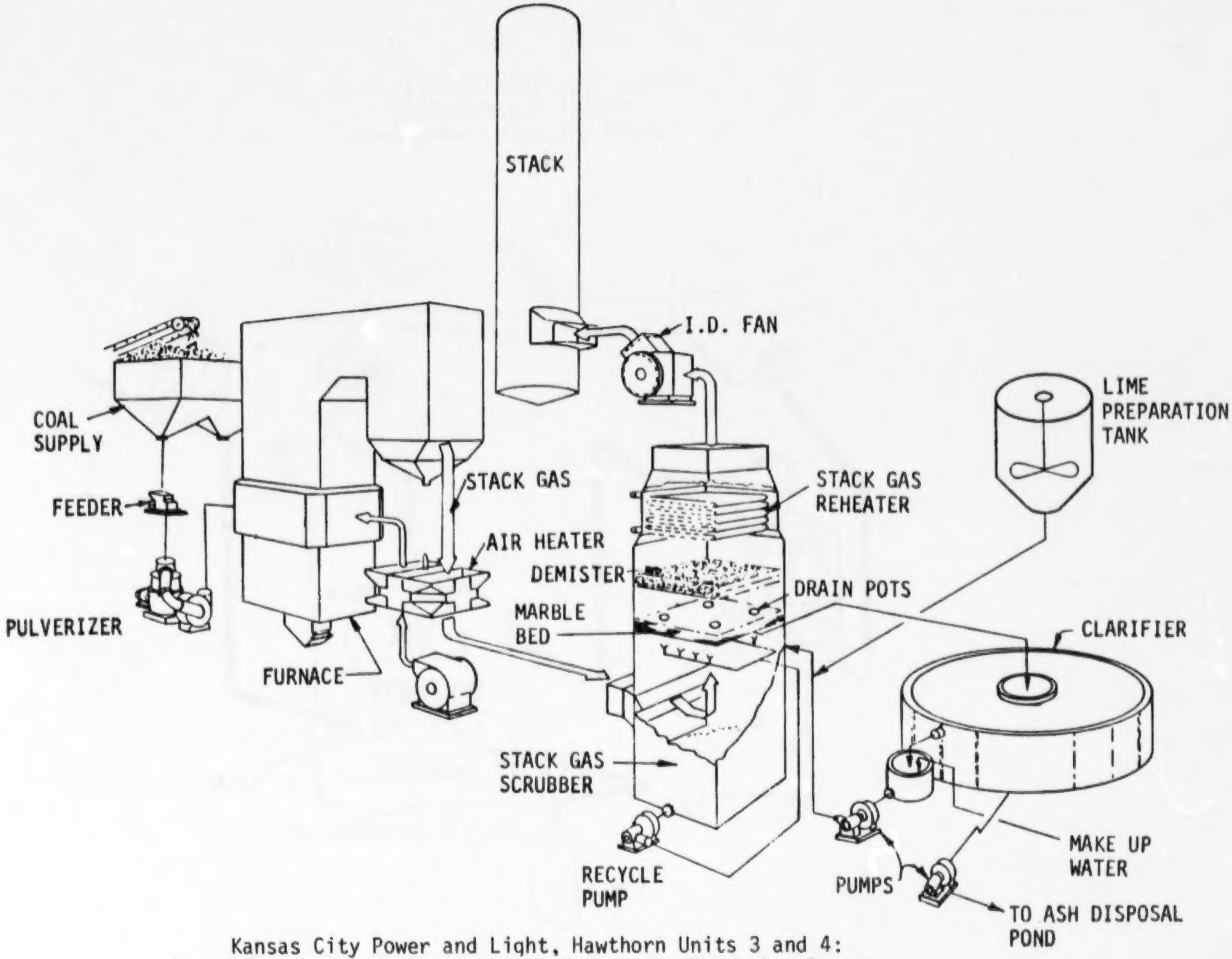
Columbus and Southern Ohio Electric, Conesville 5 and 6:
Simplified Process Flow Diagram for a Given Module


BOILER
AIR HTR
1ST STAGE
ADJUSTABLE VENTURI
FOR FLY ASH/SO_2
2ND STAGE
SO_2 ABSORBER SCRUBBER
REHEATER
STACK
FAN SPRAY
RECYCLE RETURN SYSTEM
RETURN TO POND
$CaSO_3/SO_4$
FLY ASH SLURRY
THICKENER
TRANSFER
TANK
ASH POND
TO
STABILIZATION
FACILITIES
LIME SILO
SLAKER
SLURRY
TANK
ELEVATOR

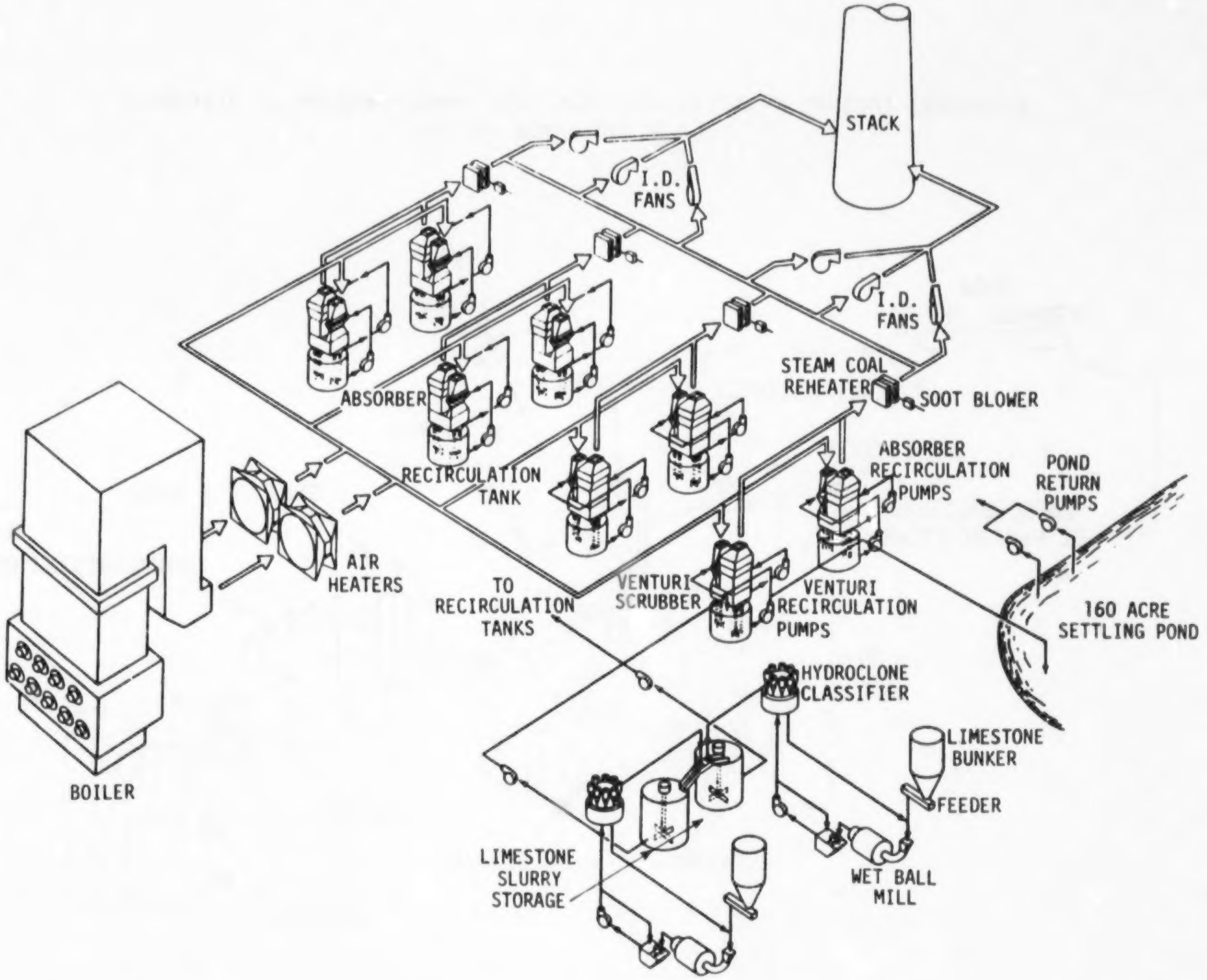
Duquesne Light, F. R. Phillips FGD System:
General Diagram.


STACK
JET BUBBLING REACTOR
WATER
LIMESTONE BIN
AIR
GYPSUM

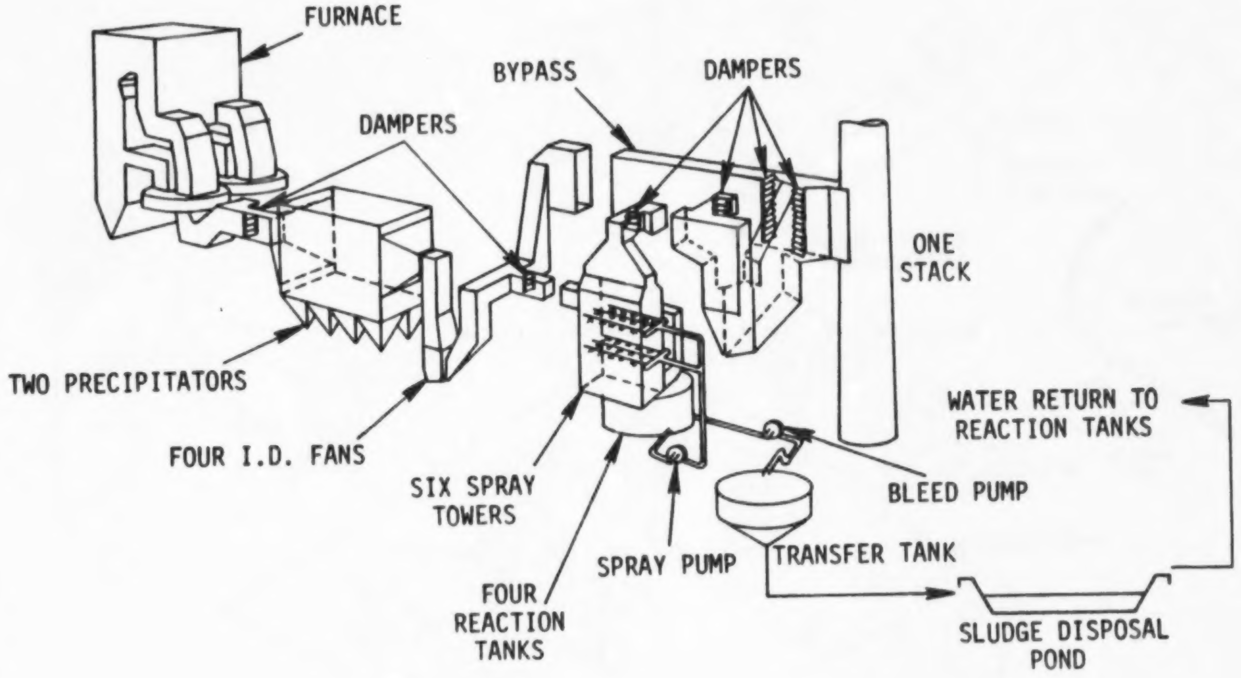
Gulf Power, Scholz 1 and 2:
Prototype FGD System,
Simplified Process Flow Diagram


STACK
I.D. FAN
LIME PREPARATION TANK
COAL SUPPLY
STACK GAS
STACK GAS REHEATER
FEEDER
AIR HEATER
DEMISTER
DRAIN POTS
PULVERIZER
MARBLE BED
CLARIFIER
FURNACE
STACK GAS SCRUBBER
MAKE UP WATER
RECYCLE PUMP
PUMPS
TO ASH DISPOSAL POND

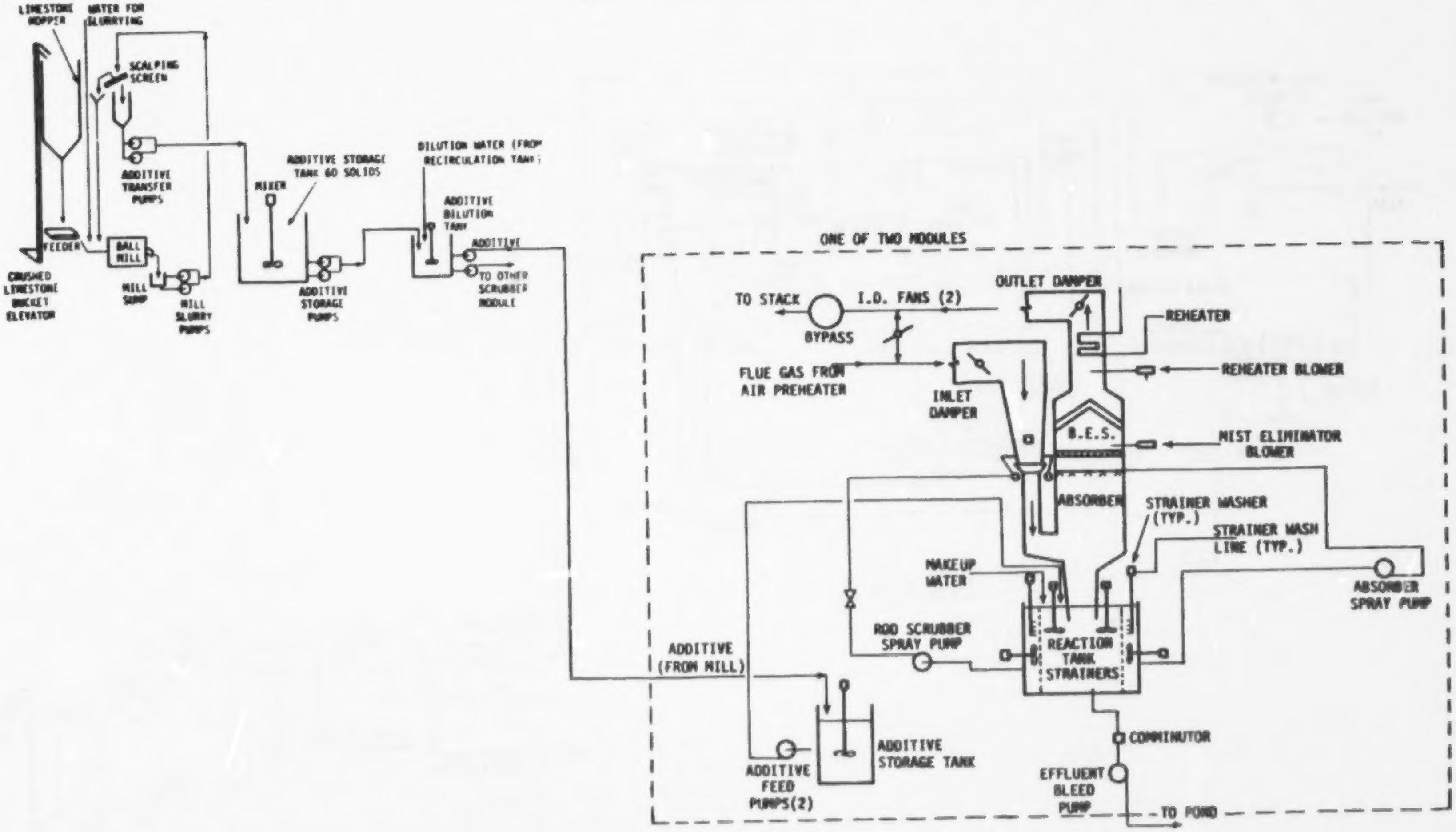
Kansas City Power and Light, Hawthorn Units 3 and 4:
Simplified Process Flow Diagram of the Lime Scrubbing Process


STACK
I.D. FANS
I.D. FANS
STEAM COAL REHEATER
SOOT BLOWER
ABSORBER
RECIRCULATION TANK
ABSORBER RECIRCULATION PUMPS
POND RETURN PUMPS
AIR HEATERS
TO RECIRCULATION TANKS
VENTURI SCRUBBER
VENTURI RECIRCULATION PUMPS
160 ACRE SETTLING POND
HYDROCLONE CLASSIFIER
LIMESTONE BUNKER
FEEDER
BOILER
LIMESTONE SLURRY STORAGE
WET BALL MILL

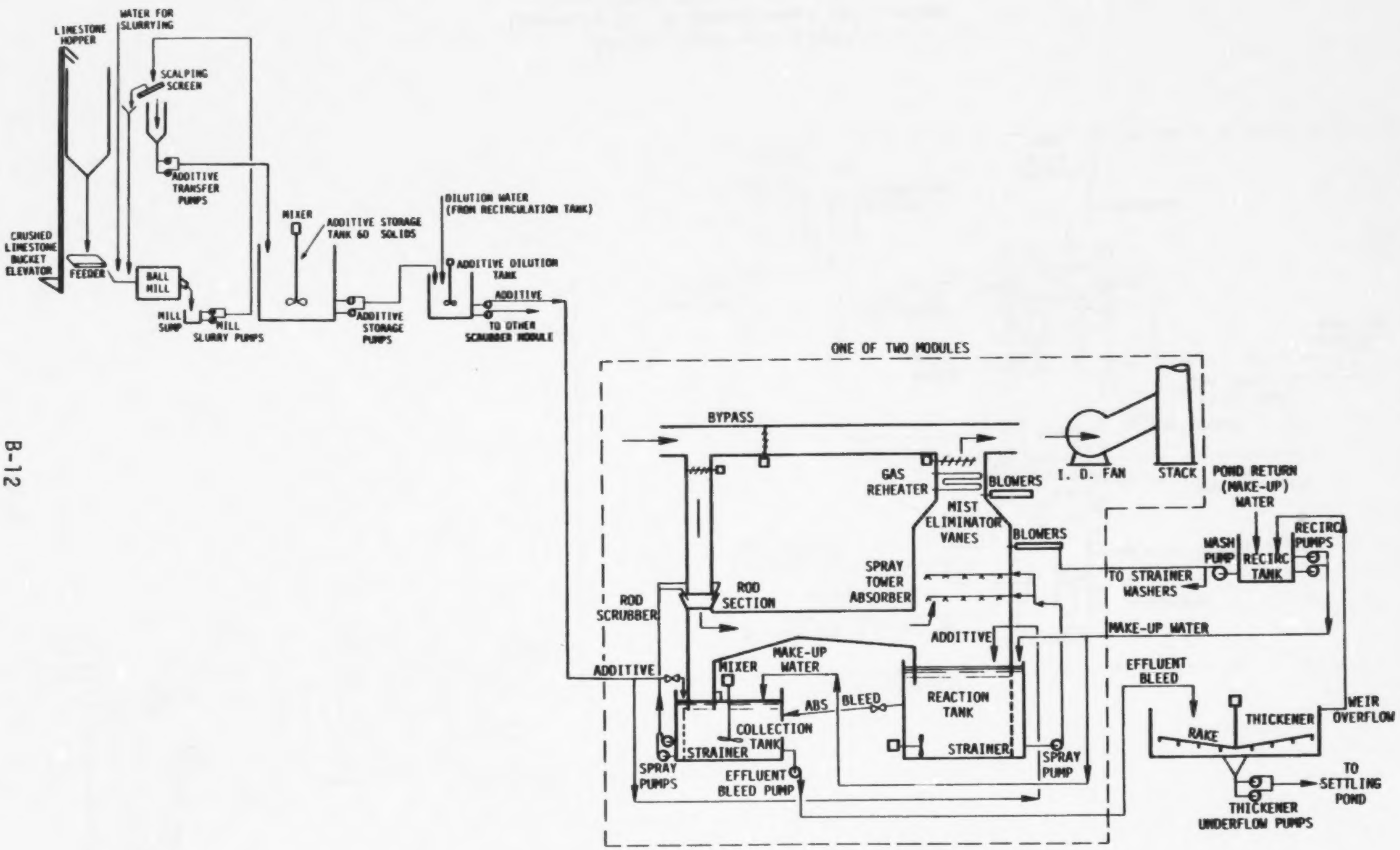
Kansas City Power and Light,
LaCygne 1 FGD System: General Diagram


FURNACE
BYPASS
DAMPERS
DAMPERS
ONE STACK
TWO PRECIPITATORS
WATER RETURN TO REACTION TANKS
FOUR I.D. FANS
SIX SPRAY TOWERS
BLEED PUMP
SPRAY PUMP
TRANSFER TANK
FOUR REACTION TANKS
SLUDGE DISPOSAL POND

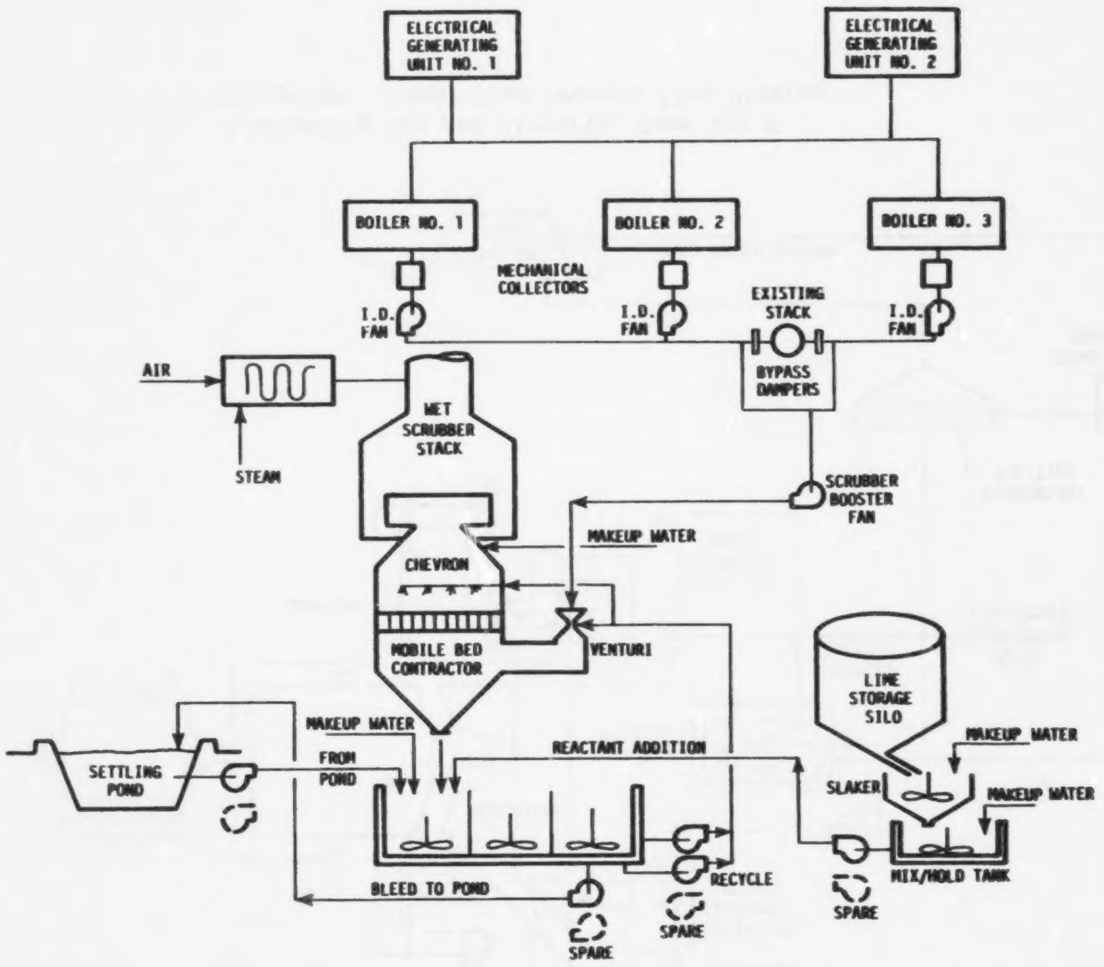
Kansas Power and Light,
Schematic of Jeffrey Steam Generator and Emission Control Equipment


LIMESTONE HOPPER
WATER FOR SLURRYING
SCALPING SCREEN
ADDITIVE TRANSFER PUMPS
FEEDER
BALL MILL
CRUSHED LIMESTONE BUCKET ELEVATOR
MILL SUMP
MILL SLURRY PUMPS
MIXER
ADDITIVE STORAGE TANK 60 SOLIDS
ADDITIVE STORAGE PUMPS
DILUTION WATER (FROM RECIRCULATION TANK)
ADDITIVE DILUTION TANK
ADDITIVE
TO OTHER SCRUBBER MODULE
ONE OF TWO MODULES
TO STACK
BYPASS
I.D. FANS (2)
OUTLET DAMPER
REHEATER
REHEATER BLOWER
FLUE GAS FROM AIR PREHEATER
INLET DAMPER
B.E.S.
MIST ELIMINATOR BLOWER
ABSORBER
STRAINER WASHER (TYP.)
STRAINER WASH LINE (TYP.)
MAKEUP WATER
ABSORBER SPRAY PUMP
ROD SCRUBBER SPRAY PUMP
REACTION TANK STRAINERS
ADDITIVE (FROM MILL)
COMMINUTOR
ADDITIVE FEED PUMPS(2)
ADDITIVE STORAGE TANK
EFFLUENT BLEED PUMP
TO POND

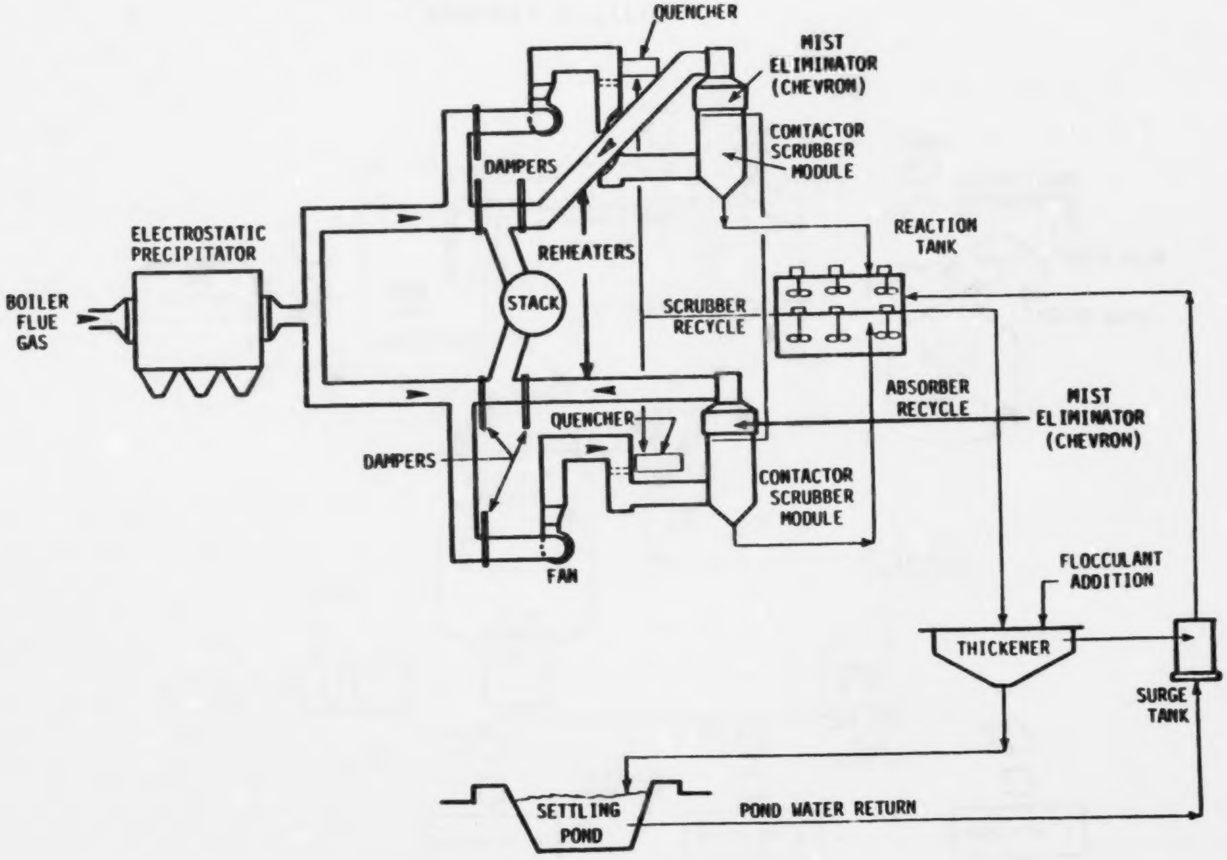
Kansas Power and Light,
Lawrence No. 4 Operational FGD System
Simplified Process Flow Diagram


LIMESTONE HOPPER
WATER FOR SLURRYING
SCALPING SCREEN
ADDITIVE TRANSFER PUMPS
CRUSHED LIMESTONE BUCKET ELEVATOR
FEEDER
BALL MILL
MILL SUMP
MILL SLURRY PUMPS
MIXER
ADDITIVE STORAGE TANK 60 SOLIDS
ADDITIVE STORAGE PUMPS
DILUTION WATER (FROM RECIRCULATION TANK)
ADDITIVE DILUTION TANK
ADDITIVE
TO OTHER SCRUBBER MODULE
ONE OF TWO MODULES
BYPASS
GAS REHEATER
BLOWERS
MIST ELIMINATOR VANES
BLOWERS
I. D. FAN
STACK
POND RETURN (MAKE-UP) WATER
WASH PUMP
RECIRC TANK
RECIRC PUMPS
TO STRAINER WASHERS
SPRAY TOWER ABSORBER
ROD SCRUBBER
ROD SECTION
ADDITIVE
MAKE-UP WATER
ADDITIVE
MIXER
MAKE-UP WATER
ABS
BLEED
REACTION TANK
COLLECTION TANK
STRAINER
STRAINER
SPRAY PUMPS
EFFLUENT BLEED PUMP
SPRAY PUMP
EFFLUENT BLEED
RAKE
THICKENER
WEIR OVERFLOW
TO SETTLING POND
THICKENER UNDERFLOW PUMPS

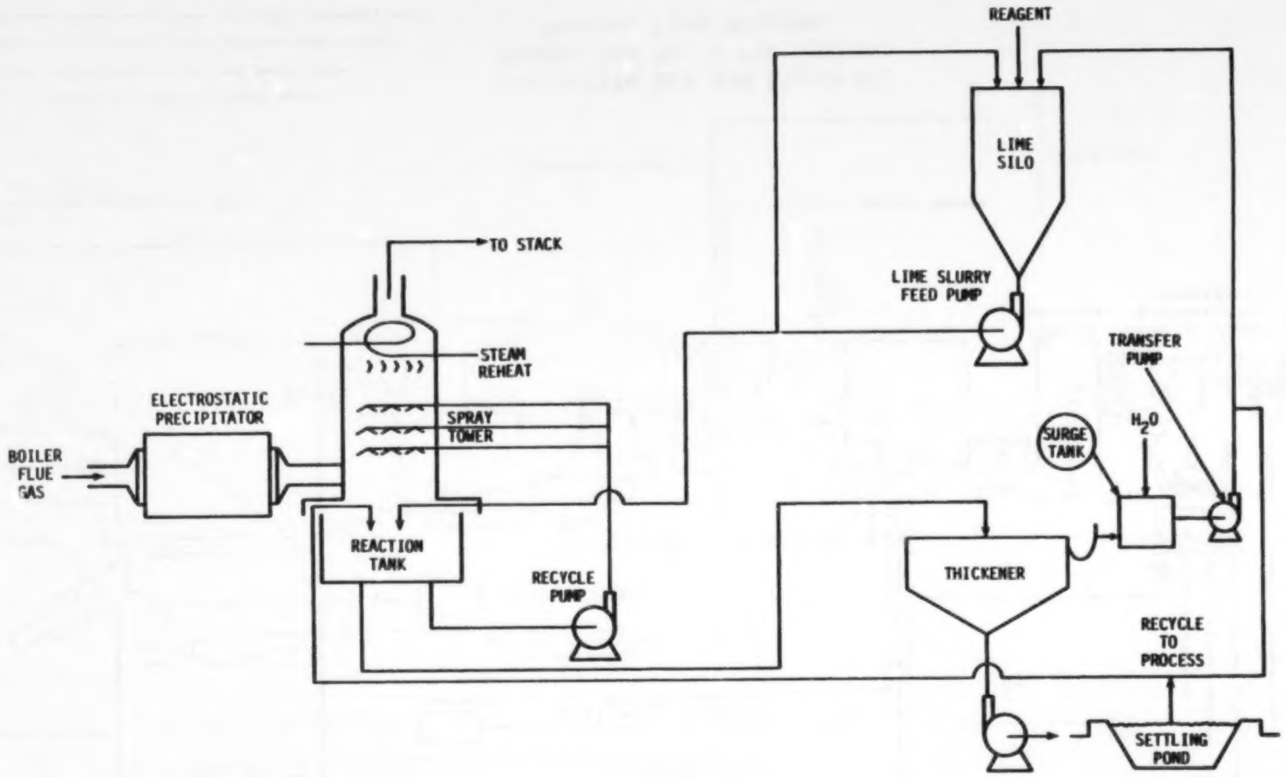
Kansas Power and Light,
Lawrence No. 5 Operational FGD System
Simplified Process Flow Diagram


ELECTRICAL GENERATING UNIT NO. 1
ELECTRICAL GENERATING UNIT NO. 2
BOILER NO. 1
BOILER NO. 2
BOILER NO. 3
MECHANICAL COLLECTORS
I.D. FAN
I.D. FAN
I.D. FAN
EXISTING STACK
BYPASS DAMPERS
AIR
STEAM
WET SCRUBBER STACK
SCRUBBER BOOSTER FAN
MAKEUP WATER
CHEVRON
MOBILE BED CONTRACTOR
VENTURI
LIME STORAGE SILO
MAKEUP WATER
SLAKER
MAKEUP WATER
MIX/HOLD TANK
SPARE
SETTLING POND
MAKEUP WATER
FROM POND
REACTANT ADDITION
RECYCLE
SPARE
BLEED TO POND
SPARE

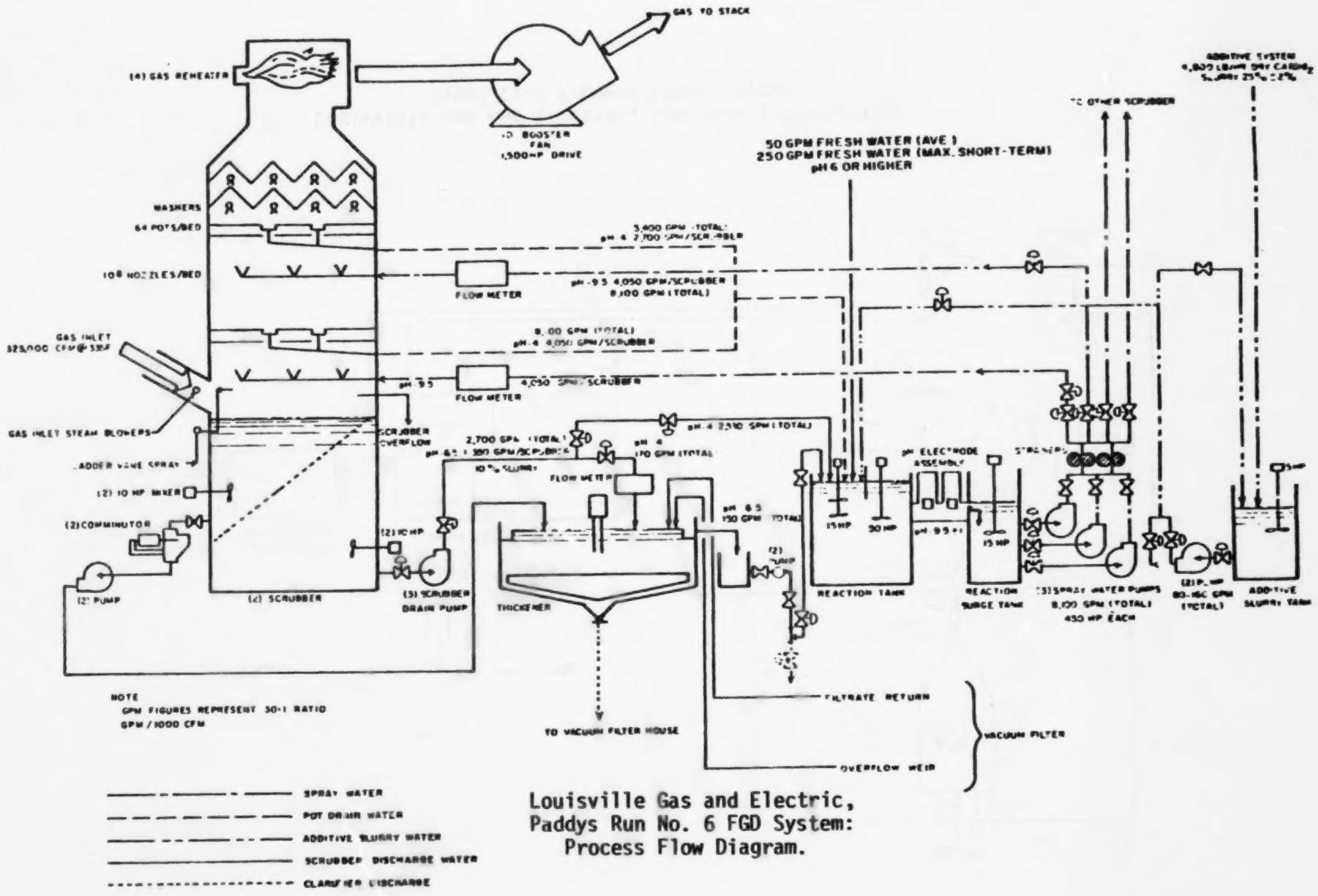
Kentucky Utilities,
Green River FGD System: General Process Diagram


QUENCHER
MIST ELIMINATOR (CHEVRON)
CONTACTOR SCRUBBER MODULE
DAMPERS
ELECTROSTATIC PRECIPITATOR
REHEATERS
REACTION TANK
BOILER FLUE GAS
STACK
SCRUBBER RECYCLE
ABSORBER RECYCLE
MIST ELIMINATOR (CHEVRON)
QUENCHER
DAMPERS
CONTACTOR SCRUBBER MODULE
FAN
FLOCCULANT ADDITION
THICKENER
SURGE TANK
SETTLING POND
POND WATER RETURN

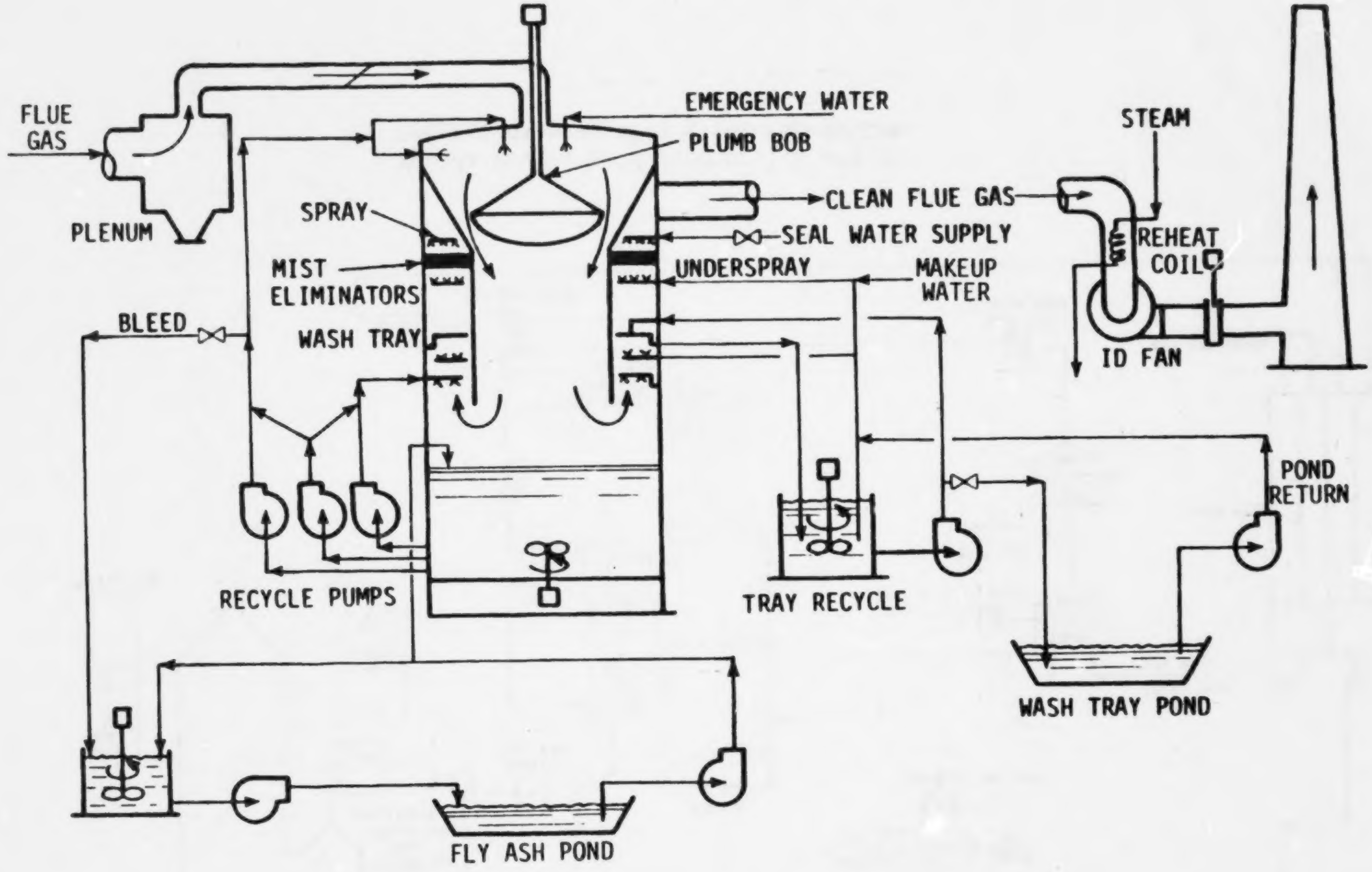
Louisville Gas and Electric, Cane Run 4
FGD System: Simplified Process Flow Diagram


REAGENT
LIME SILO
LIME SLURRY FEED PUMP
TO STACK
STEAM REHEAT
ELECTROSTATIC PRECIPITATOR
SPRAY TOWER
BOILER FLUE GAS
REACTION TANK
RECYCLE PUMP
TRANSFER PUMP
SURGE TANK
H_2O
THICKENER
RECYCLE TO PROCESS
SETTLING POND

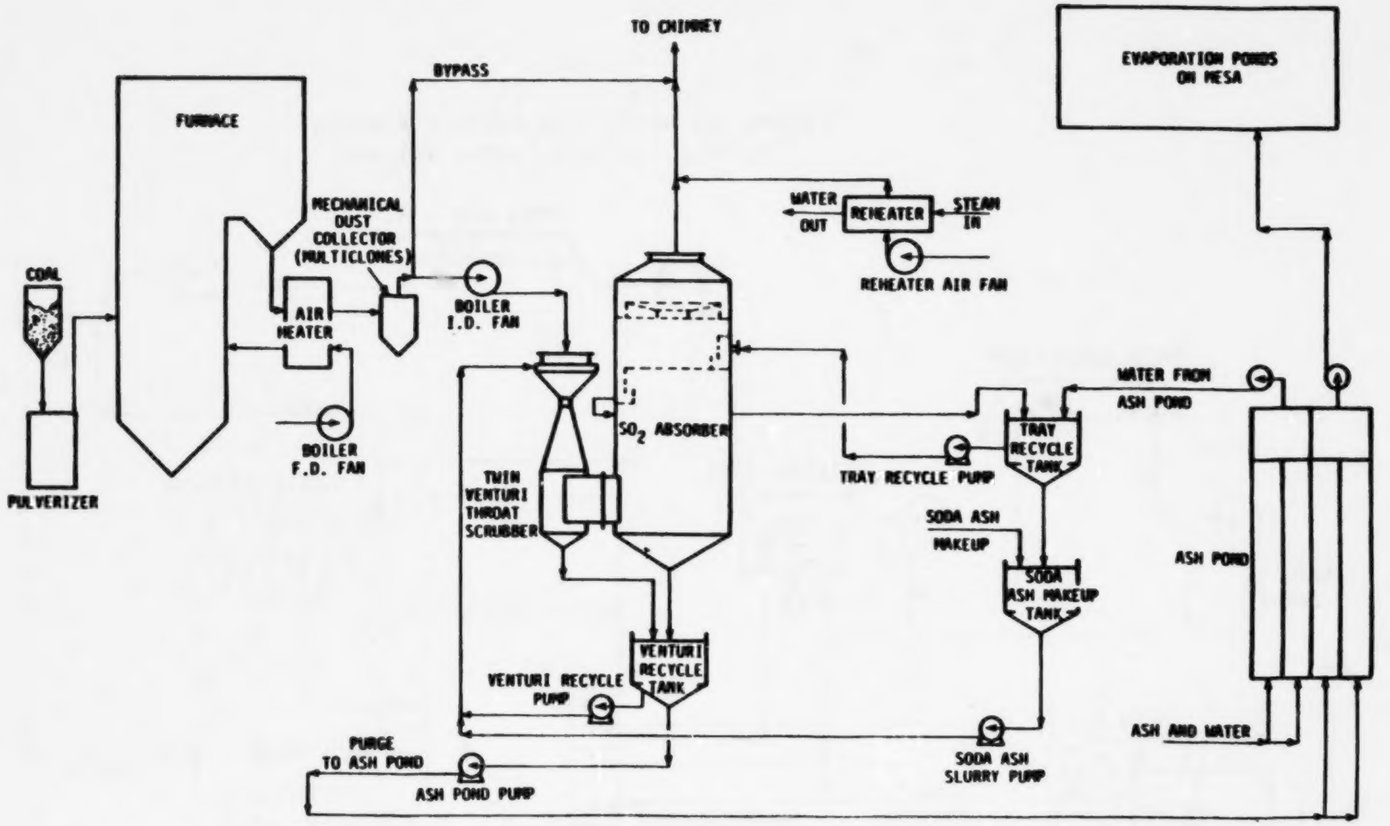
Louisville Gas and Electric, Cane Run 5 FGD System:
Simplified Process Flow Diagram


GAS TO STACK
(4) GAS REHEATER
I.D. BOOSTER FAN 1,500HP DRIVE
WASHERS
64 POTS/BED
108 NOZZLES/BED
GAS INLET 325,000 CFM@ 325F
GAS INLET STEAM BLOWERS
LADDER VANE SPRAY
(2) 10 HP MIXER
(2) COMMINUTOR
(2) PUMP
(2) SCRUBBER
SCRUBBER OVERFLOW
(2) 10 HP
(3) SCRUBBER DRAIN PUMP
3,400 GPM (TOTAL) pH 4 2,700 GPM/SCRUBBER
FLOW METER
pH 9.5 4,050 GPM/SCRUBBER 8,100 GPM (TOTAL)
8,100 GPM (TOTAL) pH 4 4,050 GPM/SCRUBBER
pH 9.5
4,050 GPM/SCRUBBER
2,700 GPM (TOTAL) pH 6.5 1,350 GPM/SCRUBBER
10% SLURRY
pH 4 170 GPM (TOTAL)
pH 4 2,530 GPM (TOTAL)
pH 6.5 150 GPM (TOTAL)
(2) PUMP
THICKENER
TO VACUUM FILTER HOUSE
FILTRATE RETURN
OVERFLOW WEIR
VACUUM FILTER
50 GPM FRESH WATER (AVE.)
250 GPM FRESH WATER (MAX. SHORT-TERM)
pH 6 OR HIGHER
15 HP
30 HP
REACTION TANK
pH ELECTRODE ASSEMBLY
pH 9.5
15 HP
REACTION SURGE TANK
STRAINERS
TO OTHER SCRUBBER
(3) SPRAY WATER PUMPS 8,100 GPM (TOTAL) 450 HP EACH
(2) PUMP 80-160 GPM (TOTAL)
ADDITIVE SYSTEM 4,800 LB/HR DRY Ca(OH)$_2$ SLURRY 25% ± 2%
5 HP
ADDITIVE SLURRY TANK
NOTE
GPM FIGURES REPRESENT 30:1 RATIO
GPM/1000 CFM
SPRAY WATER
POT DRAIN WATER
ADDITIVE SLURRY WATER
SCRUBBER DISCHARGE WATER
CLARIFIER DISCHARGE

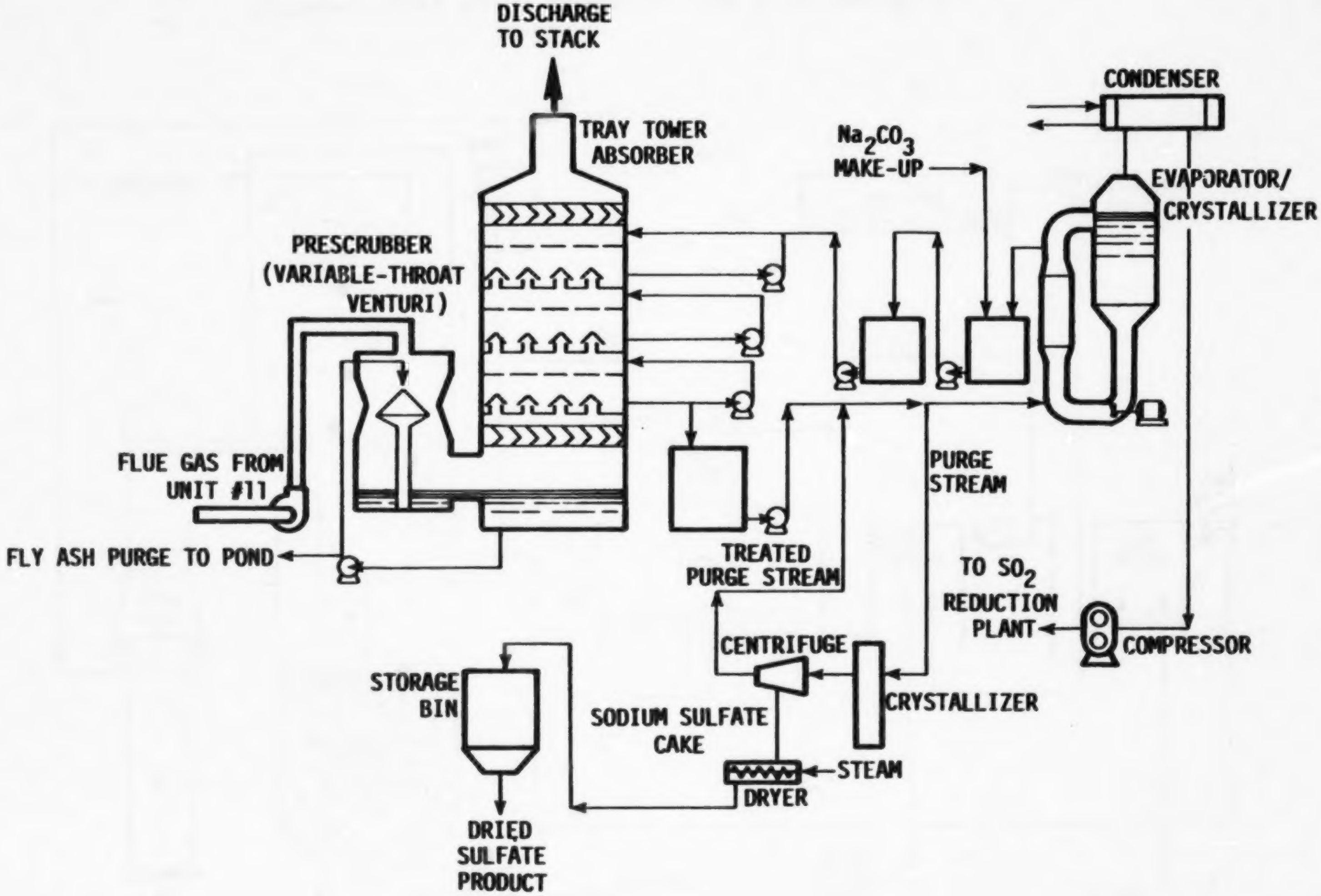
Louisville Gas and Electric, Paddys Run No. 6 FGD System: Process Flow Diagram.


FLUE GAS
PLENUM
EMERGENCY WATER
PLUMB BOB
SPRAY
MIST ELIMINATORS
WASH TRAY
BLEED
CLEAN FLUE GAS
SEAL WATER SUPPLY
UNDERSPRAY
MAKEUP WATER
STEAM
REHEAT COIL
ID FAN
RECYCLE PUMPS
TRAY RECYCLE
POND RETURN
WASH TRAY POND
FLY ASH POND

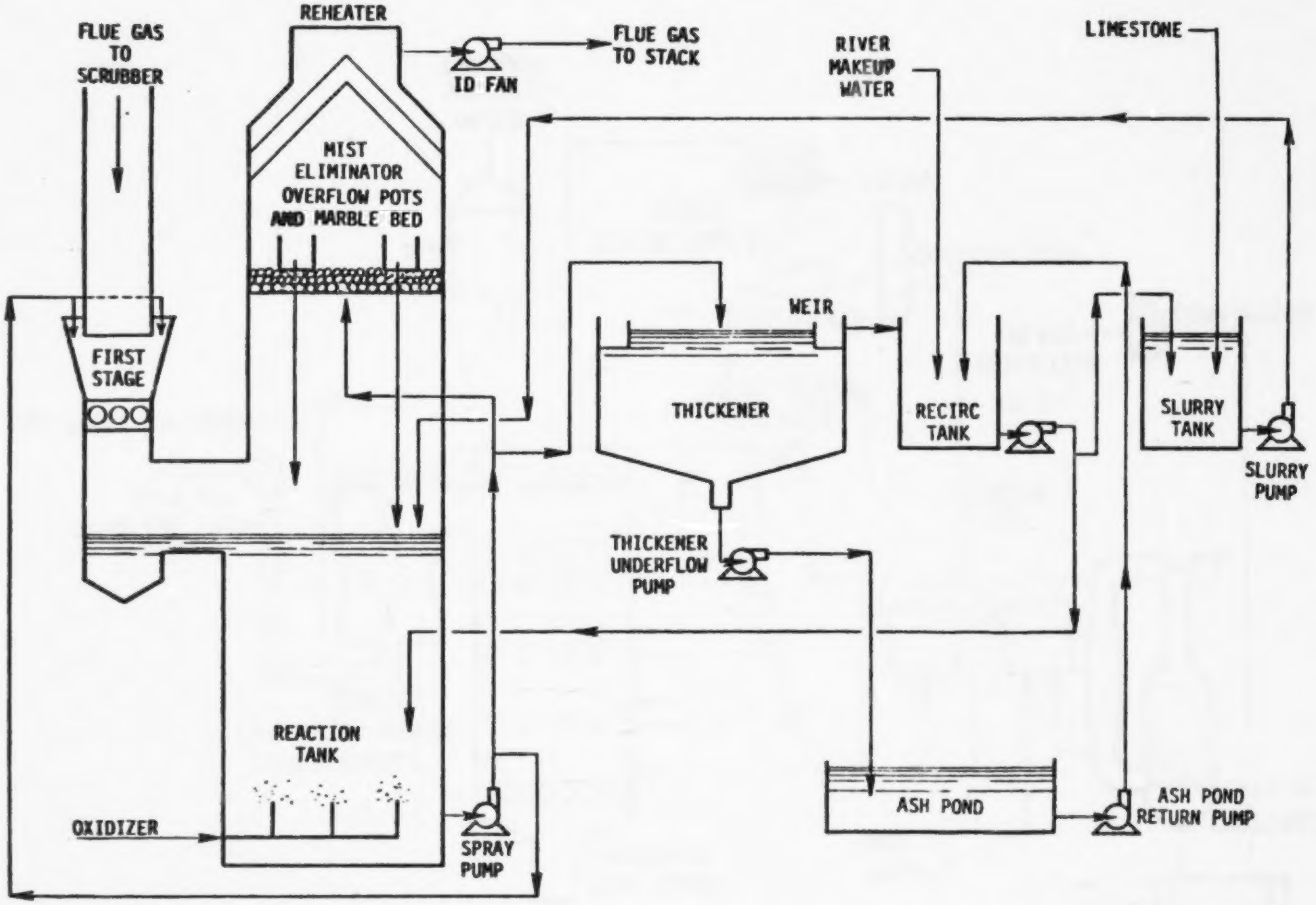
Montana Power, Colstrip 1 and 2:
Process diagram of a given FGD module.


TO CHIMNEY
BYPASS
EVAPORATION PONDS ON MESA
FURNACE
MECHANICAL DUST COLLECTOR (MULTICLONES)
COAL
AIR HEATER
BOILER I.D. FAN
WATER OUT
REHEATER
STEAM IN
REHEATER AIR FAN
BOILER F.D. FAN
PULVERIZER
SO_2 ABSORBER
TWIN VENTURI THROAT SCRUBBER
WATER FROM ASH POND
TRAY RECYCLE TANK
TRAY RECYCLE PUMP
SODA ASH MAKEUP
SODA ASH MAKEUP TANK
ASH POND
VENTURI RECYCLE TANK
VENTURI RECYCLE PUMP
PURGE TO ASH POND
ASH POND PUMP
SODA ASH SLURRY PUMP
ASH AND WATER

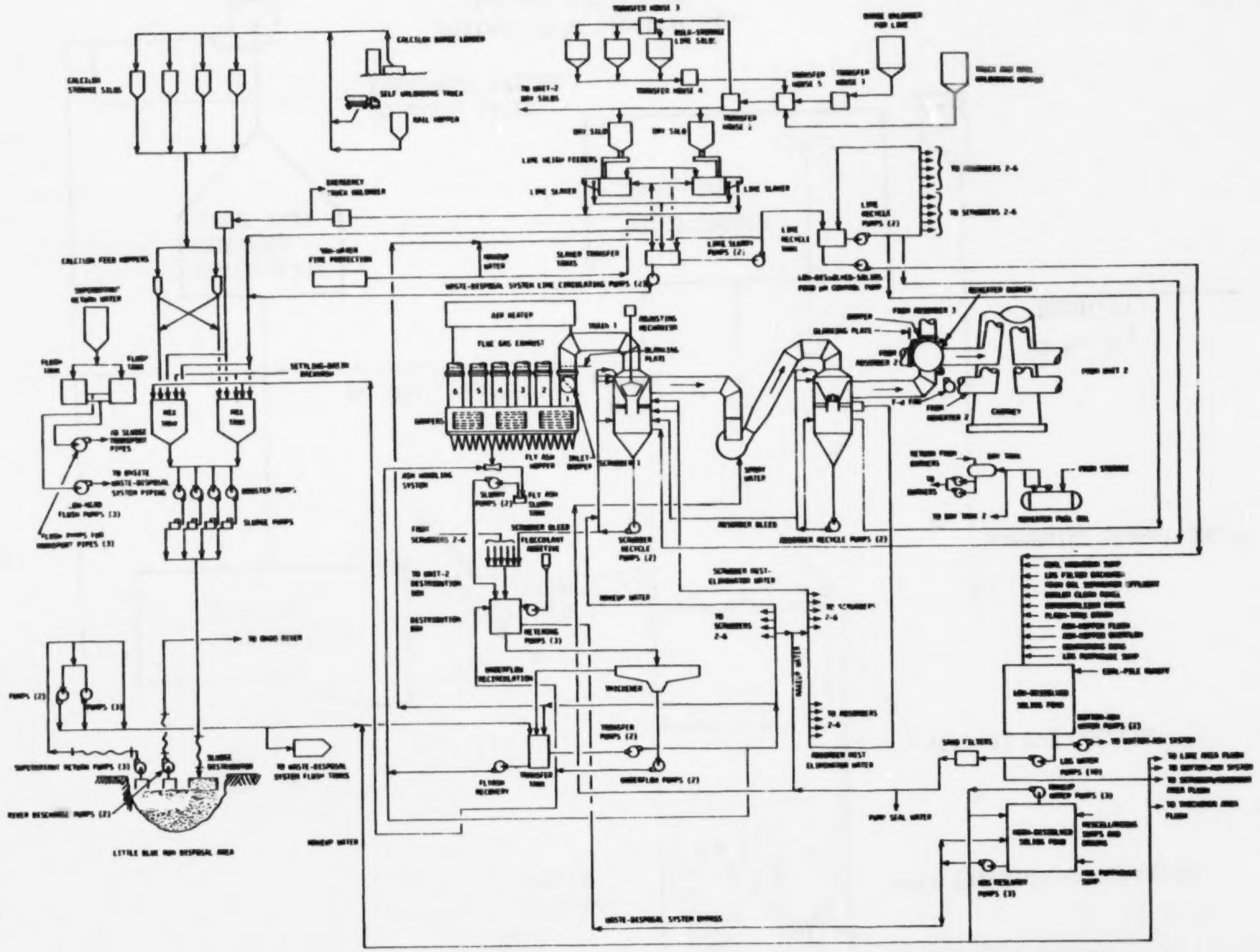
Nevada Power, Reid Gardner 1,2 and 3:
Process diagram of a given FGD system.


DISCHARGE TO STACK
TRAY TOWER ABSORBER
PRESCRUBBER (VARIABLE-THROAT VENTURI)
FLUE GAS FROM UNIT #11
FLY ASH PURGE TO POND
Na_2CO_3 MAKE-UP
CONDENSER
EVAPORATOR/ CRYSTALLIZER
PURGE STREAM
TREATED PURGE STREAM
TO SO_2 REDUCTION PLANT
COMPRESSOR
CENTRIFUGE
CRYSTALLIZER
SODIUM SULFATE CAKE
STEAM
DRYER
STORAGE BIN
DRIED SULFATE PRODUCT

Northern Indiana Public Service,
D. H. Mitchell No. 11 Wellman Lord/Allied System:
General Process Diagram.

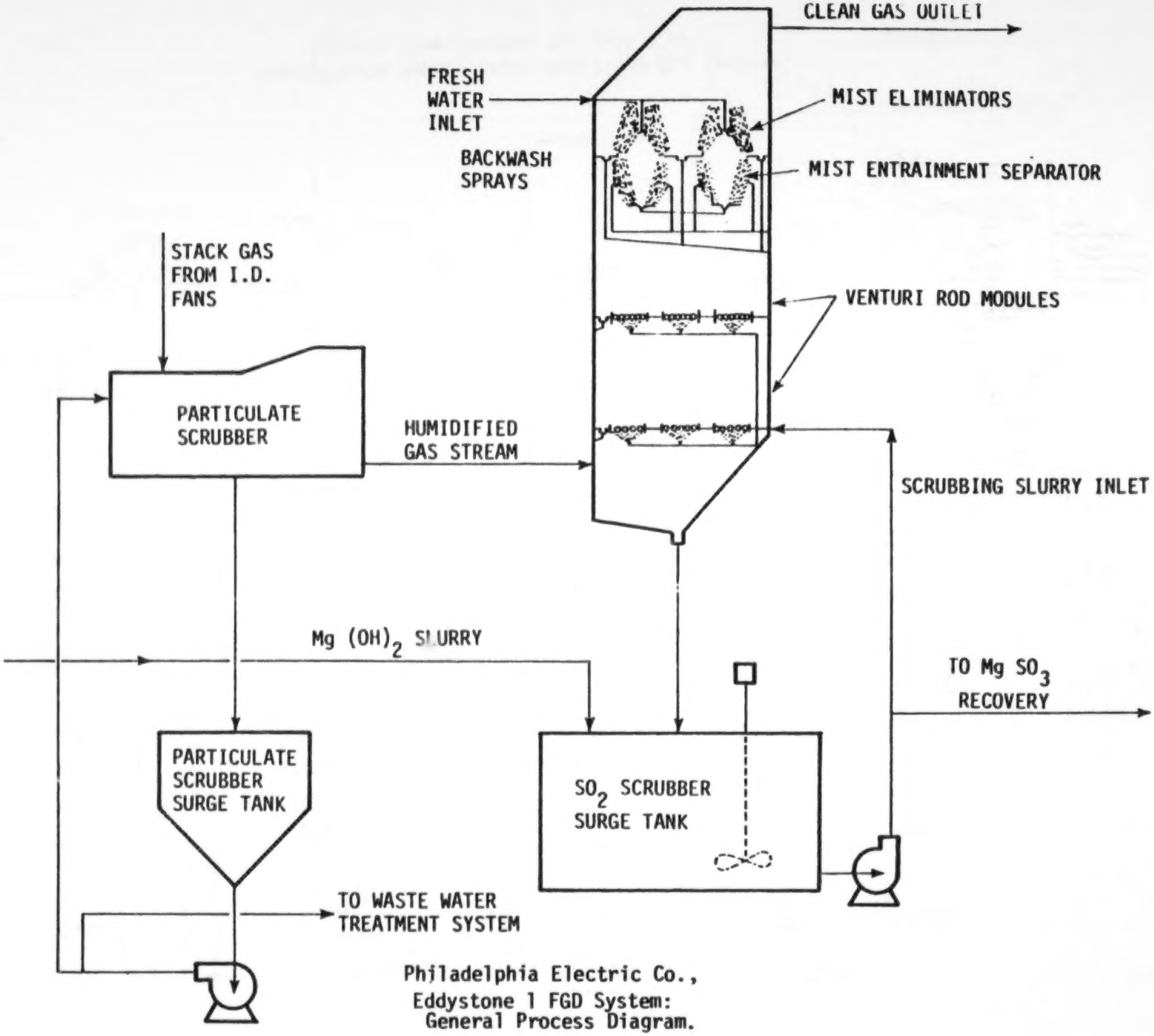

FLUE GAS
TO
SCRUBBER
REHEATER
ID FAN
FLUE GAS
TO STACK
RIVER
MAKEUP
WATER
LIMESTONE
MIST
ELIMINATOR
OVERFLOW POTS
AND MARBLE BED
FIRST
STAGE
THICKENER
WEIR
RECIRC
TANK
SLURRY
TANK
SLURRY
PUMP
THICKENER
UNDERFLOW
PUMP
REACTION
TANK
OXIDIZER
SPRAY
PUMP
ASH POND
ASH POND
RETURN PUMP

Northern States Power, Sherburne 1 and 2 FGD System:
Simplified Process Flow Diagram

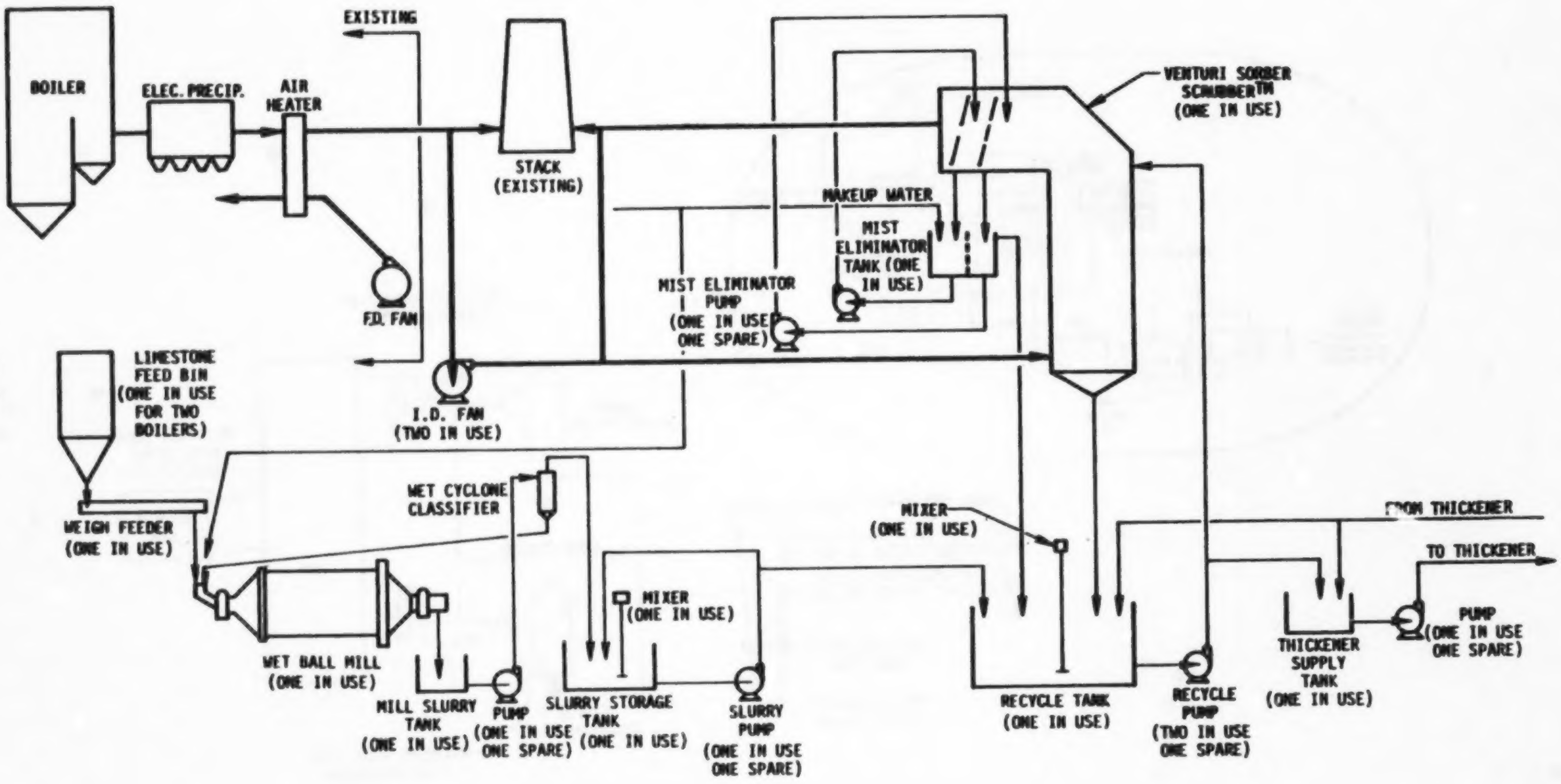

CALCIUM STORAGE SILOS
CALCIUM BARGE LOADER
SELF UNLOADING TRUCK
RAIL HOPPER
EMERGENCY TRUCK UNLOADER
CALCIUM FEED HOPPERS
SUPERNATANT RETURN WATER
FLUSH TANK
FLUSH TANK
TO SLUDGE TRANSPORT PIPES
TO ONSITE WASTE-DISPOSAL SYSTEM PIPING
LOW-HEAD FLUSH PUMPS (3)
FLUSH PUMPS FOR TRANSPORT PIPES (3)
MIX TANK
MIX TANK
BOOSTER PUMPS
SLUDGE PUMPS
SETTLING-BASIN BACKWASH
FIRE PROTECTION
MAKEUP WATER
SLAKER TRANSFER TANKS
WASTE-DISPOSAL SYSTEM LIME CIRCULATING PUMPS (2)
TRANSFER HOUSE 3
BULK-STORAGE LIME SILOS
TRANSFER HOUSE 4
TO UNIT-2 DRY SILOS
TRANSFER HOUSE 5
TRANSFER HOUSE 1
TRANSFER HOUSE 2
BARGE UNLOADER FOR LIME
TRUCK AND RAIL UNLOADING HOPPER
DRY SILO
DRY SILO
LIME WEIGH FEEDERS
LIME SLAKER
LIME SLAKER
LIME SLURRY PUMPS (2)
LIME RECYCLE TANK
LIME RECYCLE PUMPS (2)
TO ABSORBERS 2-6
TO SCRUBBERS 2-6
LOW-DISSOLVED-SOLIDS POND pH CONTROL PUMP
AIR HEATER
FLUE GAS EXHAUST
6
5
4
3
2
1
HOPPERS
FLY ASH HOPPER
INLET DAMPER
TRAIN 1
ADJUSTING MECHANISM
BLANKING PLATE
SCRUBBER 1
SPRAY WATER
REHEATER BURNER
DAMPER
BLANKING PLATE
FROM ABSORBER 3
FROM ABSORBER 2
I-D FAN
FROM REHEATER 2
CHIMNEY
FROM UNIT 2
RETURN FROM BURNERS
DAY TANK
TO BURNERS
FROM STORAGE
TO DAY TANK 2
REHEATER FUEL OIL
ABSORBER BLEED
ABSORBER RECYCLE PUMPS (2)
ASH HANDLING SYSTEM
SLURRY PUMPS (2)
FLY ASH SLURRY TANK
FROM SCRUBBERS 2-6
SCRUBBER BLEED
FLOCCULANT ADDITIVE
TO UNIT-2 DISTRIBUTION BOX
DISTRIBUTION BOX
METERING PUMPS (3)
SCRUBBER RECYCLE PUMPS (2)
SCRUBBER MIST-ELIMINATOR WATER
MAKEUP WATER
TO SCRUBBERS 2-6
TO SCRUBBERS 2-6
MAKEUP WATER
TO ABSORBERS 2-6
ABSORBER MIST ELIMINATOR WATER
UNDERFLOW RECIRCULATION
THICKENER
TRANSFER PUMPS (2)
UNDERFLOW PUMPS (2)
TRANSFER TANK
FLUSH RECOVERY
TO OHIO RIVER
PUMPS (2)
PUMPS (3)
SUPERNATANT RETURN PUMPS (3)
SLUDGE DISTRIBUTOR
TO WASTE-DISPOSAL SYSTEM FLUSH TANKS
RIVER DISCHARGE PUMPS (2)
LITTLE BLUE RUN DISPOSAL AREA
MAKEUP WATER
COAL-PILE RUNOFF
LOW-DISSOLVED SOLIDS POND
BOTTOM-ASH WATER PUMPS (2)
TO BOTTOM-ASH SYSTEM
SAND FILTERS
LDS WATER PUMPS (10)
PUMP SEAL WATER
MAKEUP WATER PUMPS (3)
HIGH-DISSOLVED SOLIDS POND
MISCELLANEOUS SUMPS AND DRAINS
HDS PUMPHOUSE SUMP
HDS RECLAIM PUMPS (3)
TO LIME AREA FLUSH
TO BOTTOM-ASH SYSTEM
TO SCRUBBER/ABSORBER AREA FLUSH
TO THICKENER AREA FLUSH
WASTE-DISPOSAL SYSTEM BYPASS

Pennsylvania Power, Bruce Mansfield FGD System:
Process Flow Diagram for Unit 1 or 2

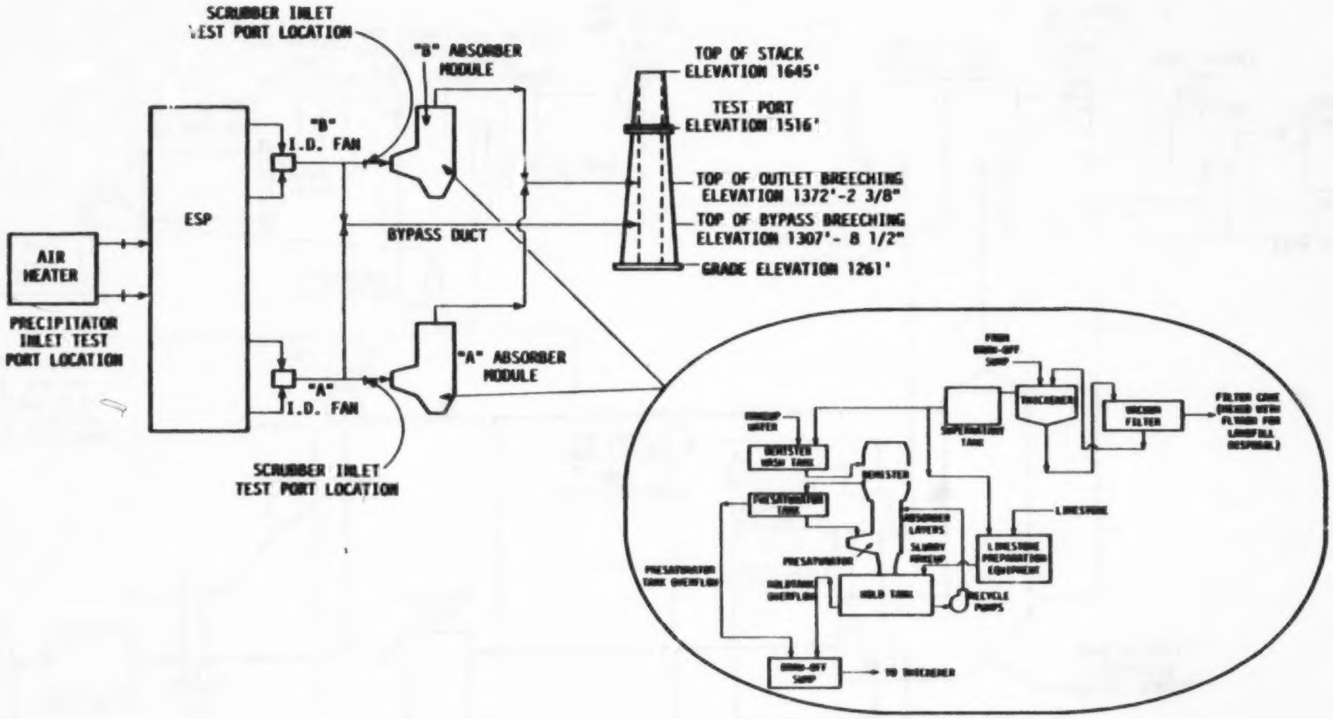
Reproduced from best available copy.


CLEAN GAS OUTLET
FRESH WATER INLET
MIST ELIMINATORS
BACKWASH SPRAYS
MIST ENTRAINMENT SEPARATOR
STACK GAS FROM I.D. FANS
VENTURI ROD MODULES
PARTICULATE SCRUBBER
HUMIDIFIED GAS STREAM
SCRUBBING SLURRY INLET
Mg (OH)$_2$ SLURRY
TO Mg SO$_3$ RECOVERY
PARTICULATE SCRUBBER SURGE TANK
SO$_2$ SCRUBBER SURGE TANK
TO WASTE WATER TREATMENT SYSTEM

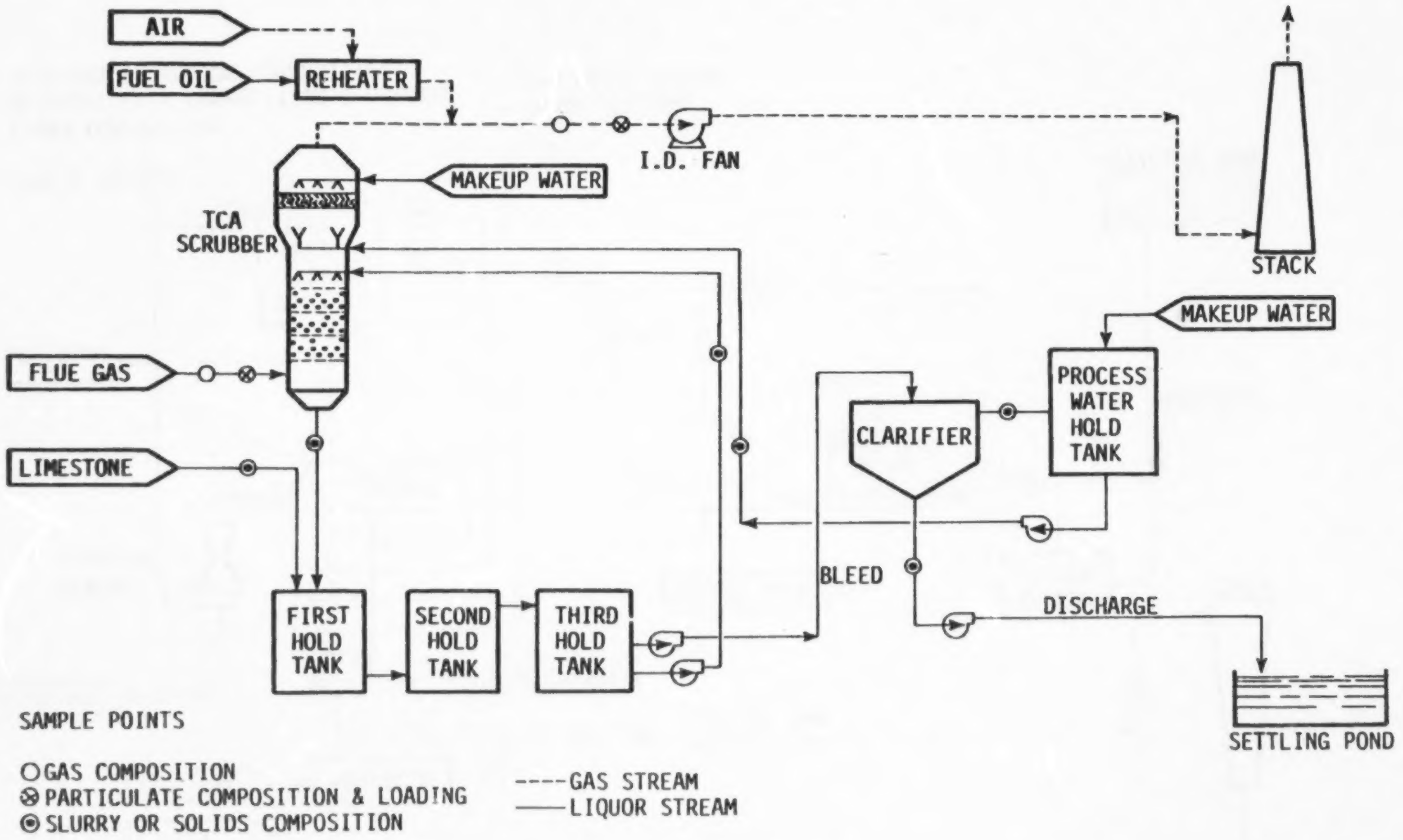
Philadelphia Electric Co.,
Eddystone 1 FGD System:
General Process Diagram.


BOILER
ELEC. PRECIP.
AIR HEATER
EXISTING
F.D. FAN
STACK (EXISTING)
I.D. FAN (TWO IN USE)
VENTURI SORBER SCRUBBER™ (ONE IN USE)
MAKEUP WATER
MIST ELIMINATOR TANK (ONE IN USE)
MIST ELIMINATOR PUMP (ONE IN USE ONE SPARE)
LIMESTONE FEED BIN (ONE IN USE FOR TWO BOILERS)
WEIGH FEEDER (ONE IN USE)
WET CYCLONE CLASSIFIER
WET BALL MILL (ONE IN USE)
MILL SLURRY TANK (ONE IN USE)
PUMP (ONE IN USE ONE SPARE)
MIXER (ONE IN USE)
SLURRY STORAGE TANK (ONE IN USE)
SLURRY PUMP (ONE IN USE ONE SPARE)
MIXER (ONE IN USE)
RECYCLE TANK (ONE IN USE)
RECYCLE PUMP (TWO IN USE ONE SPARE)
FROM THICKENER
TO THICKENER
THICKENER SUPPLY TANK (ONE IN USE)
PUMP (ONE IN USE ONE SPARE)

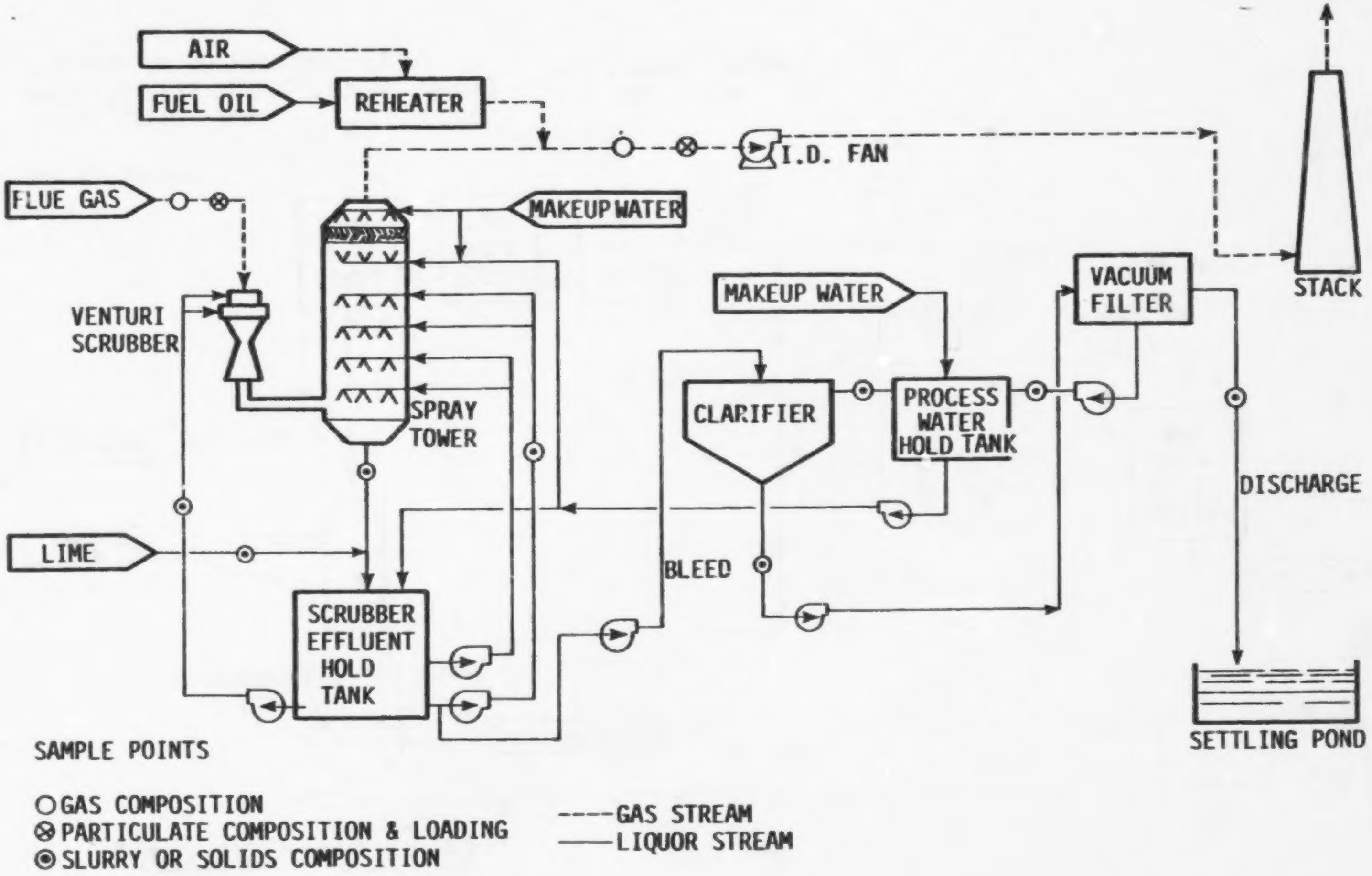
Southern Mississippi Electric, R.D. Morrow 1:
Simplified Process Flow Diagram


SCRUBBER INLET
TEST PORT LOCATION
"B" ABSORBER MODULE
"B" I.D. FAN
ESP
AIR HEATER
PRECIPITATOR INLET TEST PORT LOCATION
BYPASS DUCT
"A" I.D. FAN
"A" ABSORBER MODULE
SCRUBBER INLET TEST PORT LOCATION
TOP OF STACK ELEVATION 1645'
TEST PORT ELEVATION 1516'
TOP OF OUTLET BREECHING ELEVATION 1372'-2 3/8"
TOP OF BYPASS BREECHING ELEVATION 1307'- 8 1/2"
GRADE ELEVATION 1261'
FROM DRAW-OFF SUMP
THICKENER
VACUUM FILTER
FILTER CAKE (MIXED WITH FLYASH FOR LANDFILL DISPOSAL)
MAKEUP WATER
DEMISTER WASH TANK
SUPERNATANT TANK
DEMISTER
PRESATURATOR TANK
ABSORBER LAYERS
SLURRY MAKEUP
LIMESTONE
LIMESTONE PREPARATION EQUIPMENT
PRESATURATOR
PRESATURATOR TANK OVERFLOW
HOLDTANK OVERFLOW
HOLD TANK
RECYCLE PUMPS
DRAW-OFF SUMP
TO THICKENER

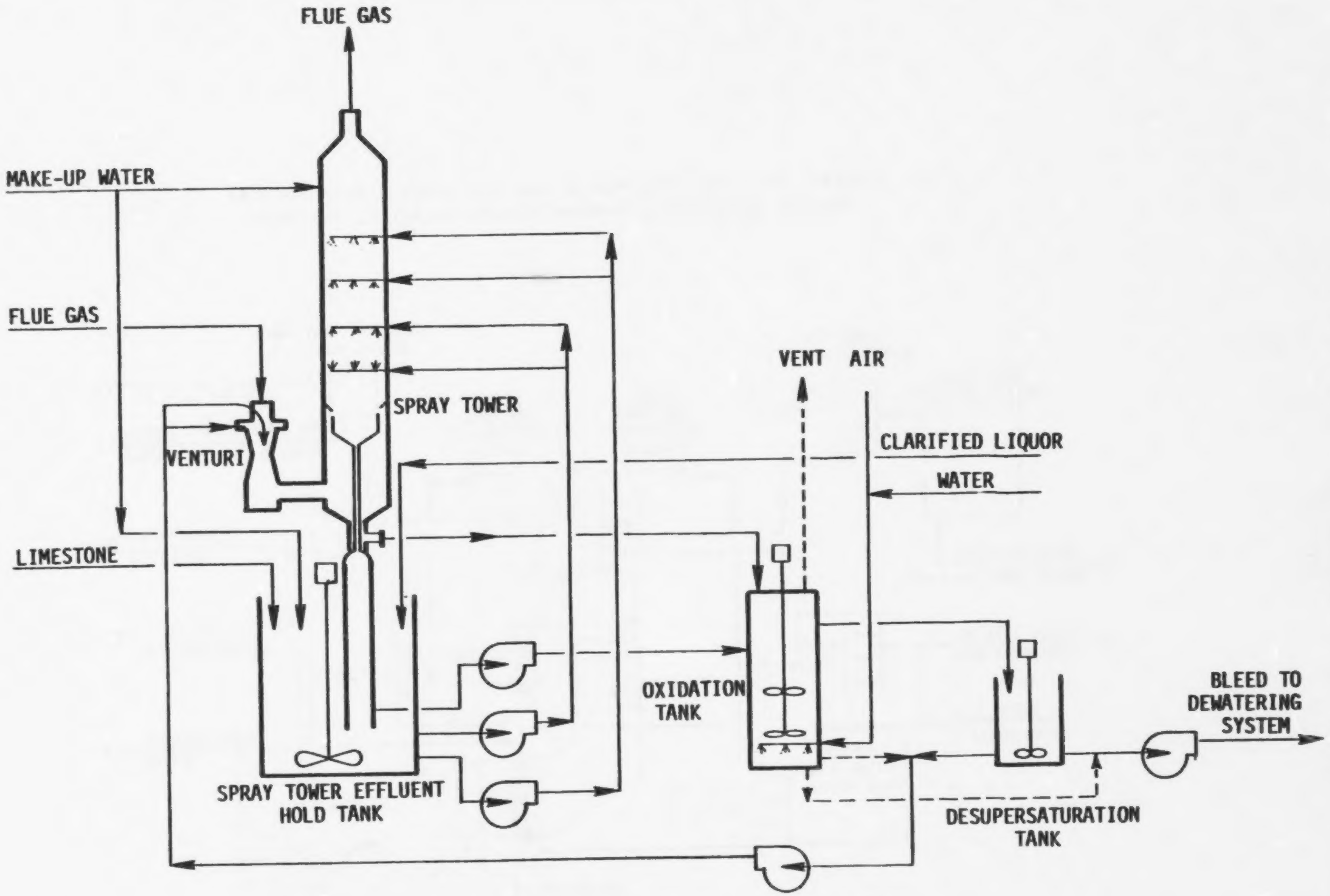
Springfield City Utilities, Southwest1:
Simplified Process Diagram


AIR
FUEL OIL
REHEATER
I.D. FAN
STACK
MAKEUP WATER
TCA SCRUBBER
FLUE GAS
LIMESTONE
FIRST HOLD TANK
SECOND HOLD TANK
THIRD HOLD TANK
BLEED
CLARIFIER
PROCESS WATER HOLD TANK
MAKEUP WATER
DISCHARGE
SETTLING POND
SAMPLE POINTS
○ GAS COMPOSITION
⊗ PARTICULATE COMPOSITION & LOADING
⊙ SLURRY OR SOLIDS COMPOSITION
---- GAS STREAM
—— LIQUOR STREAM

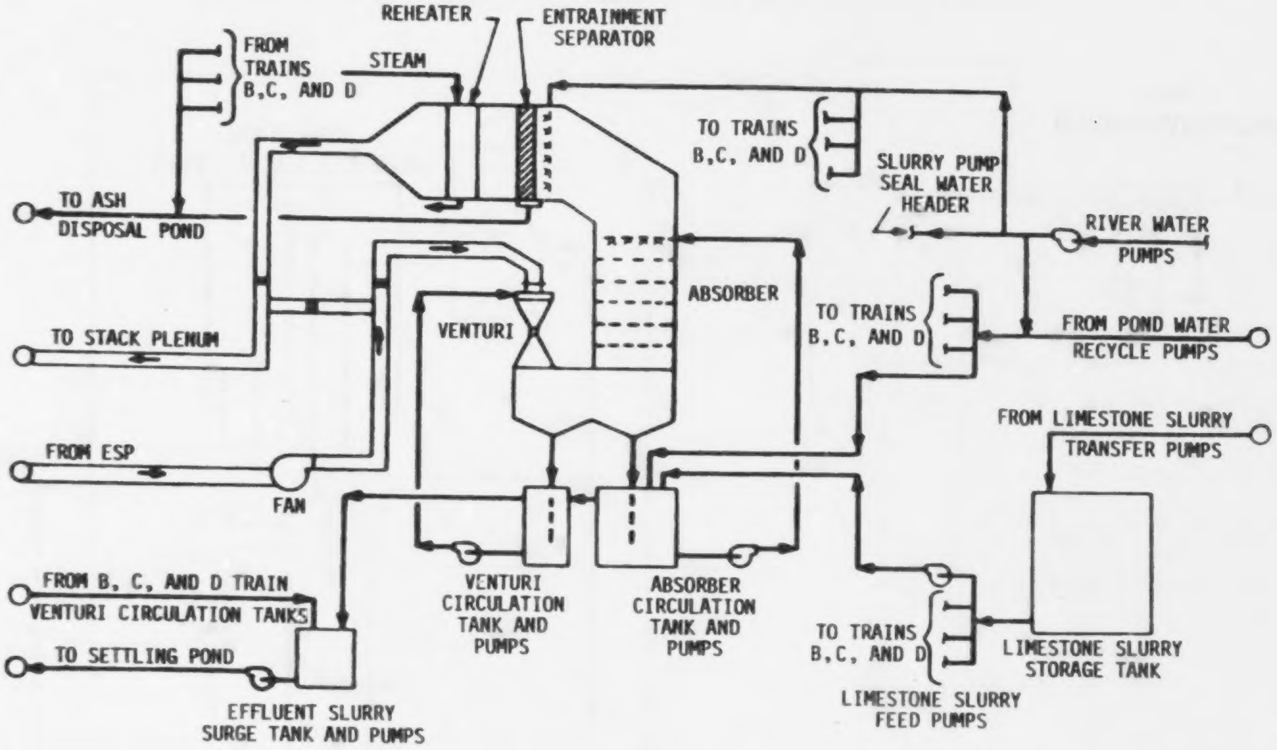
Tennessee Valley Authority,
Shawnee 10 Prototype Test Unit:
General Process Diagram.


AIR
FUEL OIL
REHEATER
I.D. FAN
FLUE GAS
MAKEUP WATER
VENTURI SCRUBBER
SPRAY TOWER
MAKEUP WATER
CLARIFIER
PROCESS WATER HOLD TANK
VACUUM FILTER
STACK
DISCHARGE
LIME
BLEED
SCRUBBER EFFLUENT HOLD TANK
SETTLING POND
SAMPLE POINTS
○ GAS COMPOSITION
⊗ PARTICULATE COMPOSITION & LOADING
⊙ SLURRY OR SOLIDS COMPOSITION
---- GAS STREAM
—— LIQUOR STREAM

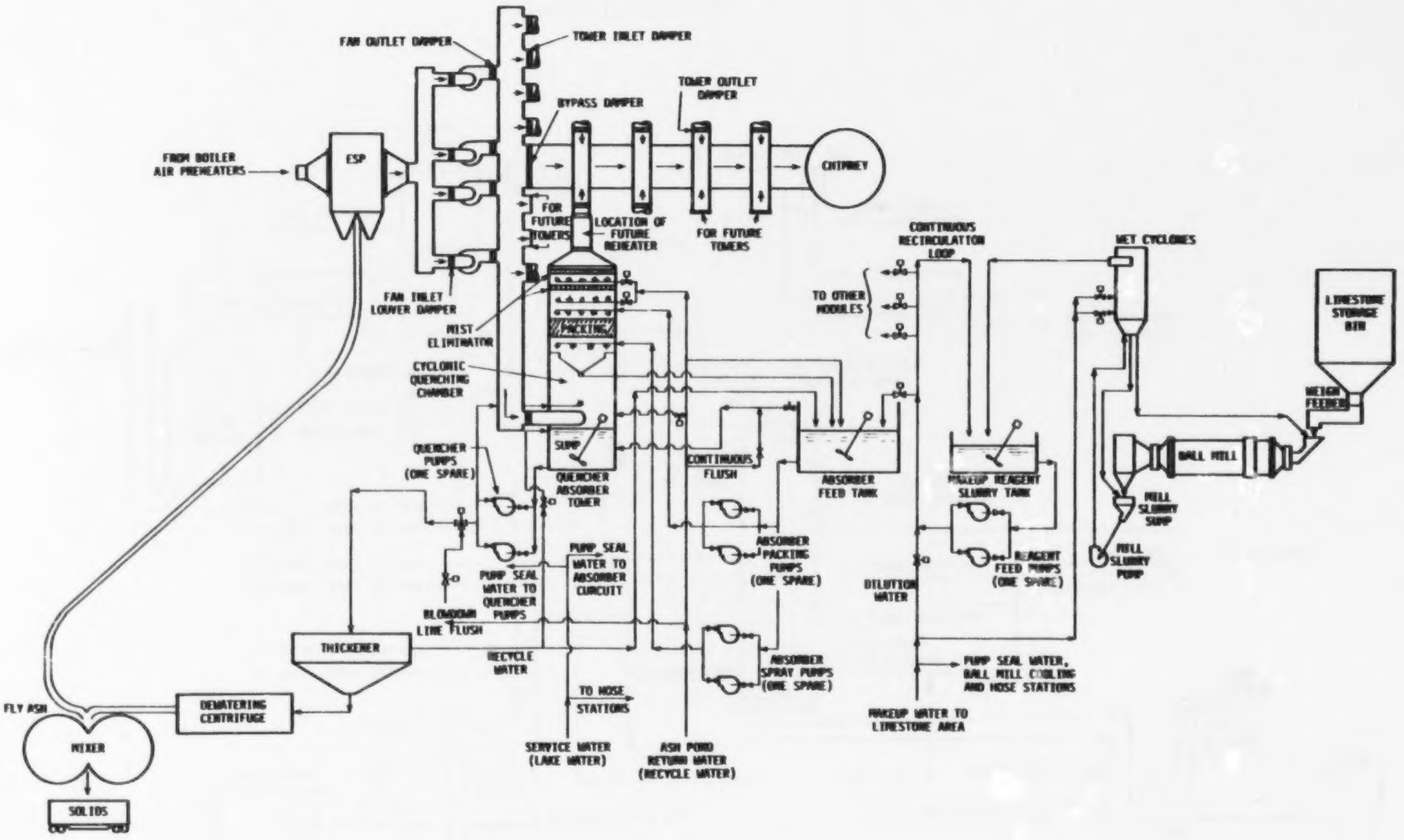
Tennessee Valley Authority, Shawnee 10 Prototype Unit: General Process Diagram.


FLUE GAS
MAKE-UP WATER
FLUE GAS
VENTURI
LIMESTONE
SPRAY TOWER
SPRAY TOWER EFFLUENT HOLD TANK
VENT
AIR
CLARIFIED LIQUOR
WATER
OXIDATION TANK
DESUPERSATURATION TANK
BLEED TO DEWATERING SYSTEM

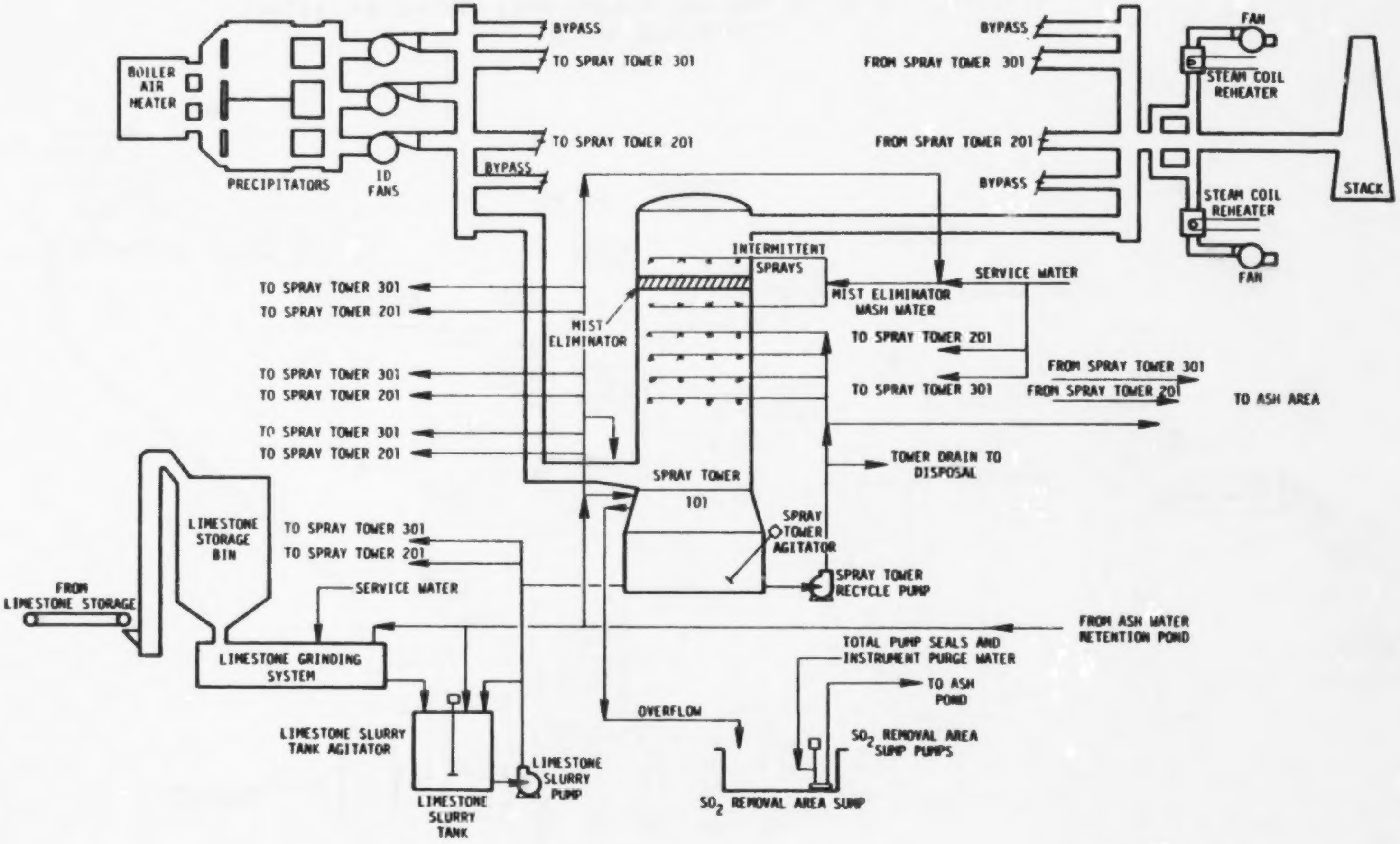
Tennessee Valley Authority, Shawnee 10 Prototype Test Unit:
Modified Venturi/Spray Tower System for 2-Stage Oxidation Testing.


REHEATER
ENTRAINMENT SEPARATOR
FROM TRAINS B,C, AND D
STEAM
TO TRAINS B,C, AND D
SLURRY PUMP SEAL WATER HEADER
TO ASH DISPOSAL POND
RIVER WATER PUMPS
ABSORBER
VENTURI
TO TRAINS B,C, AND D
FROM POND WATER RECYCLE PUMPS
TO STACK PLENUM
FROM LIMESTONE SLURRY TRANSFER PUMPS
FROM ESP
FAN
FROM B, C, AND D TRAIN VENTURI CIRCULATION TANKS
VENTURI CIRCULATION TANK AND PUMPS
ABSORBER CIRCULATION TANK AND PUMPS
TO TRAINS B,C, AND D
LIMESTONE SLURRY STORAGE TANK
TO SETTLING POND
EFFLUENT SLURRY SURGE TANK AND PUMPS
LIMESTONE SLURRY FEED PUMPS

Tennessee Valley Authority, Widows Creek 8 FGD System:
Process Flow Diagram for One of the Four Scrubber Trains


FROM BOILER AIR PREHEATERS
ESP
FAN OUTLET DAMPER
TOWER INLET DAMPER
TOWER OUTLET DAMPER
BYPASS DAMPER
CHIMNEY
FOR FUTURE TOWERS
LOCATION OF FUTURE REHEATER
FOR FUTURE TOWERS
FAN INLET LOUVER DAMPER
MIST ELIMINATOR
PACKING
CYCLONIC QUENCHING CHAMBER
SUMP
QUENCHER ABSORBER TOWER
QUENCHER PUMPS (ONE SPARE)
PUMP SEAL WATER TO QUENCHER PUMPS
PUMP SEAL WATER TO ABSORBER CIRCUIT
BLOWDOWN LINE FLUSH
RECYCLE WATER
TO HOSE STATIONS
SERVICE WATER (LAKE WATER)
ASH POND RETURN WATER (RECYCLE WATER)
CONTINUOUS FLUSH
ABSORBER FEED TANK
ABSORBER PACKING PUMPS (ONE SPARE)
ABSORBER SPRAY PUMPS (ONE SPARE)
TO OTHER MODULES
CONTINUOUS RECIRCULATION LOOP
MAKEUP REAGENT SLURRY TANK
REAGENT FEED PUMPS (ONE SPARE)
DILUTION WATER
PUMP SEAL WATER, BALL MILL COOLING AND HOSE STATIONS
MAKEUP WATER TO LIMESTONE AREA
WET CYCLONES
LIMESTONE STORAGE BIN
WEIGH FEEDER
BALL MILL
MILL SLURRY SUMP
MILL SLURRY PUMP
THICKENER
DEWATERING CENTRIFUGE
FLY ASH
MIXER
SOLIDS

Texas Utilities,
Simplified Process Flow Diagram for One of the Two Identical
Martin Lake FGD Systems


BOILER AIR HEATER
PRECIPITATORS
ID FANS
BYPASS
TO SPRAY TOWER 301
TO SPRAY TOWER 201
BYPASS
BYPASS
FROM SPRAY TOWER 301
FROM SPRAY TOWER 201
BYPASS
FAN
STEAM COIL REHEATER
STEAM COIL REHEATER
FAN
STACK
INTERMITTENT SPRAYS
SERVICE WATER
MIST ELIMINATOR WASH WATER
TO SPRAY TOWER 201
TO SPRAY TOWER 301
FROM SPRAY TOWER 301
FROM SPRAY TOWER 201
TO ASH AREA
TO SPRAY TOWER 301
TO SPRAY TOWER 201
MIST ELIMINATOR
TO SPRAY TOWER 301
TO SPRAY TOWER 201
TO SPRAY TOWER 301
TO SPRAY TOWER 201
SPRAY TOWER 101
TOWER DRAIN TO DISPOSAL
SPRAY TOWER AGITATOR
SPRAY TOWER RECYCLE PUMP
LIMESTONE STORAGE BIN
FROM LIMESTONE STORAGE
TO SPRAY TOWER 301
TO SPRAY TOWER 201
SERVICE WATER
LIMESTONE GRINDING SYSTEM
FROM ASH WATER RETENTION POND
TOTAL PUMP SEALS AND INSTRUMENT PURGE WATER
TO ASH POND
OVERFLOW
SO2 REMOVAL AREA SUMP PUMPS
LIMESTONE SLURRY TANK AGITATOR
LIMESTONE SLURRY TANK
LIMESTONE SLURRY PUMP
SO2 REMOVAL AREA SUMP

Texas Utilities,
Simplified Process Flow Diagram for Monticello 3

APPENDIX C

DEFINITIONS

DEFINITIONS

Boiler Capacity Factor:	(kWh generation in year)/maximum continuous generating capacity in kW x 8760 hr/yr).
Boiler Utilization Parameters:	Hours boiler operated/hours in period, expressed as a percentage.
Byproduct	The nature (e.g. elemental sulfur, sulfuric acid) and disposition (e.g. stockpile on site, marketed) of the end product produced by systems that generate a saleable product.
Disposal	Disposal method for throwaway product systems producing sludge including: stabilized or unstabilized sludge, interim and final disposal sites and disposal type (minefill, landfill, etc.) as well as disposal location.
Efficiency:	
Particulate Matter	The actual percentage of particulate matter removed by the emission control system (mechanical collectors, ESP, or fabric filter and FGD) from the untreated flue gas.
SO_2	The actual percentage of SO_2 removed from the flue gas by the FGD system. Design removal efficiency values are presented for nonoperational systems for which actual removal data are not available.
FGD Viability Indexes	Several parameters have been developed to quantify the viability of FGD system technology. Various terms such as "availability," "reliability," "operability," and "utilization" are used to accurately

represent the operation of any FGD system during a given period. The above-mentioned parameters are defined below and discussed briefly. The objectives of this discussion are to make the reader aware that several different definitions are being used and to select appropriate parameters that can be used for reporting purposes so that reasonably consistent comparisons can be made.

Availability Index	Hours the FGD system is available for operation (whether operated or not) divided by hours in period, expressed as a percentage. This parameter tends to overestimate the viability of the FGD system because it does not penalize for election not to operate the system when it could have been operated. Boiler downtime may tend to increase the magnitude of the parameter because FGD failures generally cannot occur during such periods.
Reliability Index	Hours the FGD system was operated divided by the hours the FGD system was called upon to operate, expressed as a percentage. This parameter has been developed in order not to penalize the FGD system for elected outages, e.g., periods when the FGD system could have been run but was not run because of chemical shortages, lack of manpower, short duration boiler operations, etc. The main problem in using this formula is the concise determination whether or not the system was "called upon to operate" during a given time period. In addition, an undefined value can

	result when the FGD system is not called upon to operate for a given period (e.g., turbine or boiler outage when FGD system is available).
FGD Operability Index	Hours the FGD system was operated divided by boiler operating hours in period, expressed as a percentage. This parameter indicates the degree to which the FGD system is actually used, relative to boiler operating time. The parameter is penalized when options are exercised not to use the FGD system in periods when the system is operable. In addition, an undefined value can result when the FGD system is not called upon to operate for a given period (e.g., turbine or boiler outage when FGD system is available).
FGD Utilization Index	Hours that the FGD system operated divided by total hours in period. This parameter is a relative stress factor for the FGD system. It is not a complete measure of FGD system viability because the parameter can be strongly influenced by conditions that are external to the FGD system (e.g., infrequent boiler operation will lower the value of the parameter although the FGD system may be highly dependable in its particular application).
End Product	
Saleable	The SO_2 removed from the flue gas is recovered in a usable or marketable form (e.g., sulfur, sulfuric acid, gypsum, ammonium sulfate, sodium sulfate).

Throwaway	The SO_2 removed from the flue gas is not recovered in a usable or marketable form and resulting sulfur-bearing waste products must be disposed in an environmentally acceptable fashion.
Energy Consumption, %	The percentage of gross unit electrical generating capacity consumed by the FGD system, as defined by the following equation: [Net MW w/o FGD - Net MW w/FGD]/ Gross unit rating]
Equivalent Scrubbed Capacity (ESC)	The effective scrubbed flue gas in equivalent MW based on the percent of flue gas scrubbed by the FGD system.
FGD Status:	
Category 1	Operational - FGD system is in service removing SO_2.
Category 2	Under Construction - ground has been broken for installation of FGD system, but FGD system has not become operational.
Category 3	Planned, Contract Awarded - contract has been signed for purchase of FGD system but ground has not been broken for installation.
Category 4	Planned, Letter of Intent Signed - letter of intent has been signed, but legal contract for purchase has not been awarded.
Category 5	Planned, Requesting/Evaluating Bids - bid requests have been released but no letter of intent or contract has been issued.
Category 6	Considering only FGD Systems - an FGD system is proposed as a means to meet an SO_2 regulation.

Category 7	Considering an FGD system as well as alternative methods.
Category 8	Nonoperational - FGD system has been operated in the past but has been shut down permanently or for an extended indefinite period of time.
FGD Vendor	A firm that fabricates and supplies flue gas desulfurization systems.
Fuel Characteristics	Type of fuel, average gross heating value in Btu/lb. average percent ash and average percent sulfur content for fuel as fired.
General Process Type	The manner in which the SO_2 from the flue gas is collected, e.g. wet scrubbing, spray drying, dry adsorption.
New	FGD unit and boiler were designed at the same time or space for addition of an FGD unit was reserved when boiler was constructed.
Process Additives	A chemical compound or element which is added to the process or normally found with the main process reagent in small quantities (e.g. Mg, adipic acid) to promote improved process operation (e.g. scale reduction, increased SO_2 removal efficiency).
Process Type	Company name if process is patented. Generic name if several companies have similar processes (e.g., Lime, Limestone, Wellman Lord, Thoroughbred 121).

Regulatory Class	A. New boiler constructed subject to Federal New Source Performance Standards (NSPS), 8/17/71. B. Existing boiler subject to State Standard that is more stringent than the NSPS, 8/17/71. C. Existing boiler subject to State Standard that is equal to or less stringent than NSPS, 8/17/71. D. Other (unknown, undetermined).
Retrofit	FGD unit will be/was added to an existing boiler not specifically designed to accommodate FGD unit.
Start-up Date	Date when initial SO_2 removal began or is scheduled to begin.
Total Controlled Capacity [TCC]	The gross rating (MW) of a unit brought into compliance with FGD, regardless of the percent of flue gas treated at the facility. In the case of prototype and demonstration FGD systems, this figure will be identical to the Equivalent Scrubbed Capacity rather than the gross unit rating if the system is not meant to bring the facility into compliance with SO_2 emission standards.
Total FGD System Lost Generation Factor	The total monthly lost generation hours due to FGD train outages divided by the total monthly expected generation if the FGD trains would have been available for operation, expressed as a percentage.
Unit Location	City and State listed in mailing address.

Unit Name	Unit identification as it appears in Electrical World - Directory of Electrical Utilities, McGraw-Hill - Current Edition - or as indicated by utility representative for installations in planning stages.
Unit Rating	
Gross	Operational - Maximum continuous gross generation capacity in MW; Preoperational - maximum continuous design generation capacity in MW.
Net w/FGD	Gross unit rating less the energy required to operate ancillary station equipment, inclusive of emission control systems.
Net w/o FGD	Gross unit rating less the energy required to operate ancillary station equipment, exclusive of emission control systems.
Utility Name	Name of corporation as it appears in Electrical World - Directory of Electrical Utilities, McGraw-Hill - Current Edition - as space permits.
Water Make-Up	Gallons per minute of make-up water required per MW of capacity.

APPENDIX D

TABLE OF UNIT NOTATION

TABLE OF UNIT NOTATION

Classification	English Unit	Symbol	Survey Report Notation	ASTM/SI Unit	Symbol	Survey Report Notation
Area	Acre	acre	ACRE	Square meter	M^2	SQ.M
	Square foot	ft^2	SQ.FT	Square meter	M^2	SQ.M
Concentration	Grains per standard cubic foot	gr/scf	GR/SCF	Grams per cubic meter	g/m^3	G/CU.M
	Parts per million	ppm	PPM	Parts per million	ppm	PPM
	Pounds per million Btu	$lb/10^6$ Btu	LB/MMBTU	Nanograms per joule	ng/J	NG/J
Flow	Actual cubic feet per minute	ft^3/min (actual)	ACFM	Cubic meters per second	m^3/s	CU.M/S
	Gallons per minute	gal/min	GPM	Liters per second	liter/s	LITER/S
	Pounds per minute	lb/min	LB/MIN	Kilogram per second	kg/s	KG/S
	Ton per day	t/day	TPD	Metric ton per day	M t/d	M T/D
	Ton per hour	t/h	TPH	Metric ton per hour	M t/h	M T/H
Heat Content	Btu per pound	Btu/lb	BTU/LB	Kilojoule per kilogram	kJ/kg	KJ/KG
Length	Foot	ft	FT	Meter	m	M
	Inch	in	IN	Centimeter	cm	CM
	Mile	mi	MI	Kilometer	km	KM
L/G Ratio	Gallons per thousand actual cubic feet	gal/1000 ft^3 (actual)	GAL/1000ACF	Liters per cubic meter	$liter/m^3$	LITER/CU.M
Mass/Weight	Pound	lb	LB	Kilogram	kg	KG
	Ton	t	T	Megagram	Mg	MG
Pressure	Inches of water	in. H_2O	IN. H_2O	Kilopascal	kPa	KPA
Temperature	Degree Fahrenheit	°F	F	Degree Celsius	°C	C
Volume	Cubic feet	ft^3	CU.F	Cubic meter	m^3	CU.M
	Acre-feet	Acre-ft	ACRE-FT	Cubic meter	m^3	CU.M